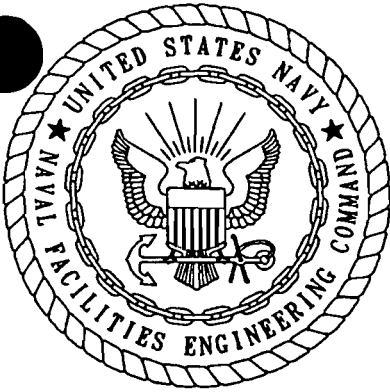


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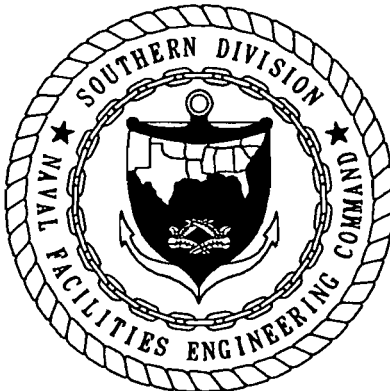


REMEDATION PLANNING DOCUMENT

**NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI**

**UNIT IDENTIFICATION CODE: N62604
CONTRACT NO. N62467-89-D-0317/128**

AUGUST 2000



**SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
NORTH CHARLESTON, SOUTH CAROLINA
29419-9010**

REMEDATION PLANNING DOCUMENT
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

Unit Identification No.: N62604

Contract No.: N62467-89-D-0317/128

Prepared by:

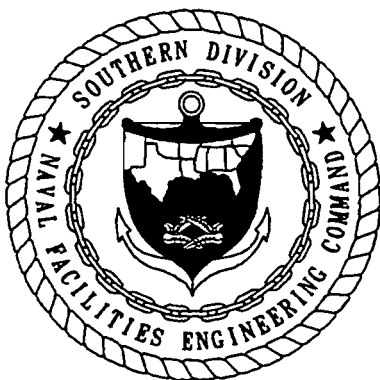
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Art Conrad, Code 1865, Remedial Project Manager

August 2000



FOREWORD

To meet its mission objectives, the U.S. Navy performs a variety of operations, some requiring the use, handling, storage, or disposal of hazardous materials. Through accidental spills and leaks and conventional methods of past disposal, hazardous materials may have entered the environment in ways unacceptable by today's standards. With growing knowledge of the long-term effects of hazardous materials on the environment, the Department of Defense initiated various programs to investigate and remediate conditions related to suspected past releases of hazardous materials at their facilities.

One of these programs is the Installation Restoration (IR) program. This program complies with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA), the Resource Conservation and Recovery Act (RCRA), and the Hazardous and Solid Waste Amendments (HSWA) of 1984. These acts establish the means to assess and clean up hazardous waste sites for both private-sector and Federal facilities.

The Southern Division, Naval Facilities Engineering Command manages and the U.S. Environmental Protection Agency and the Mississippi Department of Environmental Quality oversee the Navy environmental program at Naval Construction Battalion Center (NCBC), Gulfport, Mississippi. All aspects of the program are conducted in compliance with State and Federal regulations, as ensured by the participation of these regulatory agencies.

Questions regarding the delisting petition at NCBC Gulfport should be addressed to Mr. Art Conrad, Code 1865, at (843) 820-5520.

EXECUTIVE SUMMARY

The purpose of this remediation planning document is to address remediation of dioxin-contaminated soil and sediment caused by the storage of herbicide orange (HO) at the Naval Construction Battalion Center (NCBC) in Gulfport, Mississippi. The document presents data relevant to the proposed remedial action, provides recommended risk-based remediation goals, provides recommended elements of the proposed remedial action, and identifies design elements and issues to be addressed in the design of the final remedial action.

The proposed remedial action is to excavate and transport contaminated soil and sediment to Site 8A and provide a subbase and final cover to allow the NCBC to use the completed site. The proposed remedial action is complex, with many aspects that will require careful planning and coordination. Many design elements noted here will require some alteration based on pilot testing and the Feasibility Study (FS) to be conducted prior to actual remediation. Elements of the proposed remedial action include the following.

- Spreading construction rubble that is already on Site 8A to a maximum thickness of 2 feet.
- Excavating and transporting dioxin-contaminated soil and sediment from on-base drainage ditches and the off-base swamp to Site 8A.
- Providing temporary covers for excavated materials to control erosion.
- Mixing the transported materials with ash at the covered area along with any other necessary amendments. Spreading the mixture on the site, covering construction rubble already spread on the covered area.
- Placing a subbase and a final cover over the dioxin-contaminated mixture to prevent contact with dioxin-contaminated material at Site 8A and to prevent migration of dioxin-contaminated material from Site 8A under normal use conditions. The cover will allow the future site use to be determined by the Navy. The assumed future use is a lay-down (parking lot/storage) area.

In December 1999, HLA collected soil or sediment samples from Site 8A, Site 8B, the on-base ditches, and the swamp. Results of the physical analyses of the samples indicate that the proposed remedial action is feasible.

For the remedial goal, it is recommended that soils be excavated to the soil remediation goal of 50 parts per trillion (ppt) and that sediments be excavated to the sediment remediation goal of 102 ppt. In areas where work or changes in the existing drainage system are likely, it is recommended that sediments be excavated to the soil remediation goal of 50 ppt.

Further delineation sampling is recommended, especially in the swamp where complete delineation to the remediation goal has not been accomplished. Adequate confirmation sampling is needed during and after the remedial action to verify with acceptable certainty that all soil and sediment has been excavated to meet the risk-based remediation goal.

Obtaining proper permits and access agreements is essential to performing the remedial action. Subsection 5.15.3 discusses regulatory requirements. In addition, maintaining good community relations is vital to the public acceptance of the remedial action. The base has maintained an honest, effective community relations program throughout the history of dioxin-related studies and activities both on and off base. This program should be continued and include schedules for public notices, public comment periods, and public meetings.

The remedial action will require proper site preparation, materials handling, transportation, and contamination control. Preventing the spread of contamination into clean areas will be critical. The transport of dioxin-contaminated soil and sediment from the swamp across 28th Street must comply with applicable United States Department of Transportation regulations.

Excavated areas will be restored. For the on-base drainage ditches, surface water diversion systems should be dismantled and flow restored in the ditches. Any damaged ground surface should be repaired and any damaged vegetation should be replaced. The FS should further investigate areas in 8B and 8C where previous sampling found concentrations exceeding the risk-based remediation goal. A site restoration plan should be developed as part of the access agreement for the swamp areas. Recommended restoration activities in the swamp include removing temporary roadways and placing clean fill in any excavated area.

The change in surface material resulting from the completed cover for Site 8A will significantly increase the surface water runoff from the site. A stormwater detention system is recommended so that, following implementation of the remedial action, the NCBC baseline drainage conditions will not be adversely impacted. The stormwater detention system should require minimal maintenance.

A long-term monitoring program is recommended to ensure that contamination is not being released from the covered area. The long-term monitoring program should include groundwater monitoring for dioxin outside the perimeter of the covered area.

Land use controls (LUCs) are recommended to ensure future use of the base will not endanger human health. LUCs are necessary for the on-base covered area (Site 8A), Site 8B, Site 8C, and the on-base ditches. Restrictions should prohibit uses, such as housing developments, that would allow uncontrolled contact with the waste material underneath the cover and subgrade or in the ditches. Deed restrictions are recommended for the swamp to ensure future use is compatible with dioxin concentrations remaining in soil in the swamp following completion of the remedial action.

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Gulfport, Mississippi

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GLOSSARY

AASHTO	American Association of State Highway Transportation Officials
ABB-ES	ABB Environmental Services, Inc.
AF	acre feet
ARAR	Applicable or relevant and appropriate requirement
ASTM	American Society for Testing and Materials
CAMU	corrective action management unit
CBR	California Bearing Ratio
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	cubic feet per second
CN	Curve Number
CSEA	Community Survey and Exposure Assessment
2,4-D	2,4-dichlorophenoxyacetic acid
DOD	Department of Defense
DRE	destruction and removal efficiency
FS	Feasibility Study
g/m ³	grams per cubic meter
HLA	Harding Lawson Associates
HMR	Hazardous Material Regulations
HO	herbicide orange
K _{ow}	octanol-water partition coefficient
LUCAP	LUC Assurance Plan
LUC	Land use control
MCL	maximum contaminant level
MSDEQ	Mississippi Department of Environmental Quality
NCBC	Naval Construction Battalion Center
NP	Non-plastic
NPL	National Priorities List
PCA	Portland Cement Association
ppb	parts per billion
ppq	parts per quadrillion
ppt	parts per trillion
RAC	Remedial Action Contractor
RCRA	Resource Conservation and Recovery Act
RD&D	Research, Development, and Demonstration
SAP	Sampling and Analysis Plan
SCS	Soil Conservation Service
SPT	Standard Penetration Test
SRT	sediment recovery trap
Σ	Summation

GLOSSARY (Continued)

2,4,5-T	2,4,5-trichlorophenoxyacetic acid
2,3,7,8-TCDD	2,3,7,8-tetrachlordibenzo-p-dioxin
T _c	time of concentration
TEF	toxicity equivalency factor
TEQ	toxic equivalent
TR	Technical Release
USAF	U.S. Air Force
USCS	United Soil Classification System
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency

1.0 INTRODUCTION

1.1 PURPOSE AND OBJECTIVES. The purpose of this remediation planning document is to support remediation of dioxin-contaminated soil and sediment caused by the storage of herbicide orange (HO) at the Naval Construction Battalion Center (NCBC) in Gulfport, Mississippi. This document will be utilized to provide technical and other information during the Feasibility Study (FS).

The objectives of the remediation planning document are to:

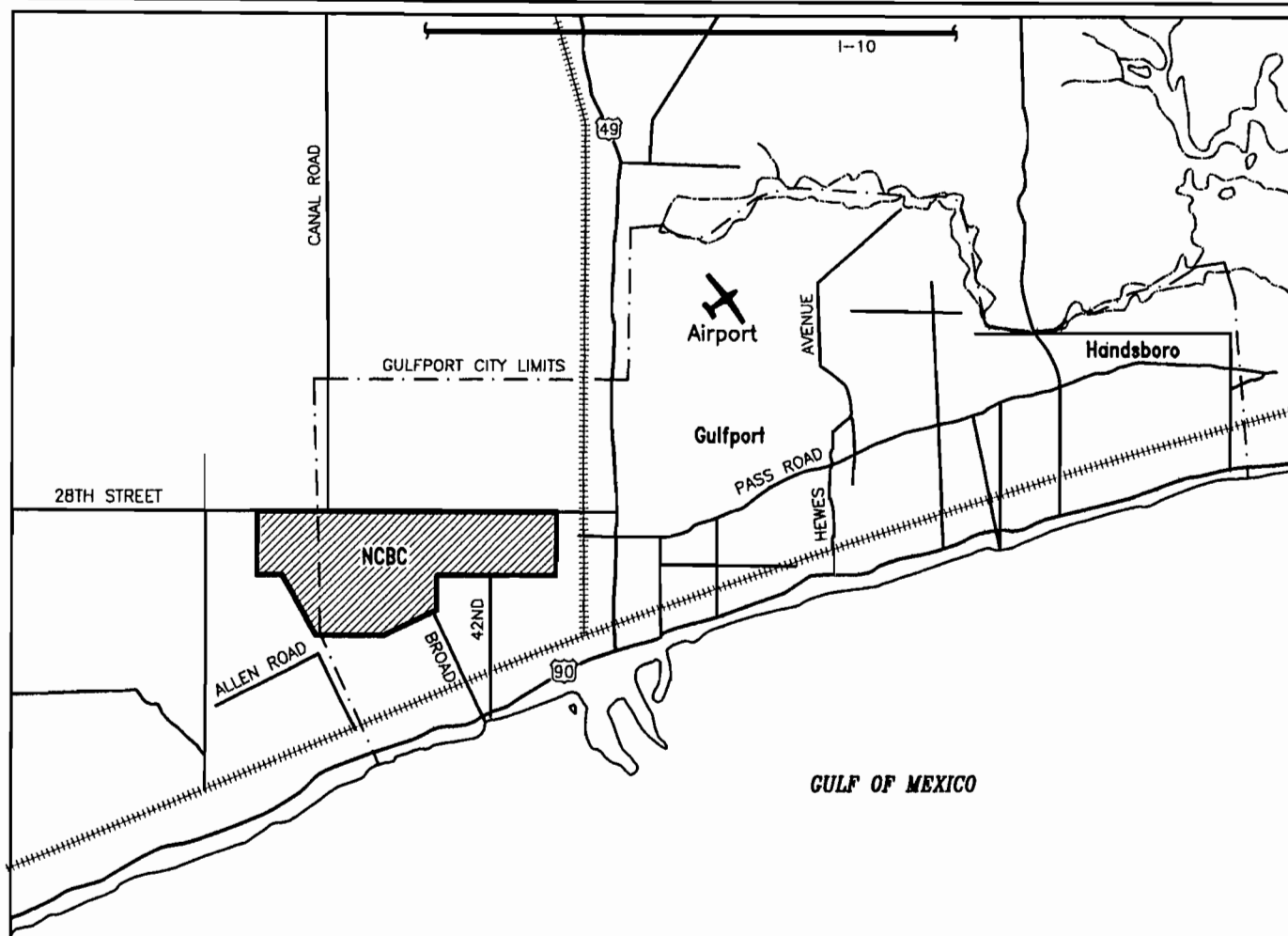
- present data relevant to the proposed remedial action,
- provide recommended elements of the proposed remedial action, and
- identify design elements and issues to be addressed in the design of the final remedial action.

1.2 LOCATION AND DESCRIPTION. NCBC Gulfport is located in the southeastern corner of Mississippi, approximately 2 miles north of the Gulf of Mexico. The majority of the base occupies land in the western part of the City of Gulfport, in Harrison County. Figure 1-1 shows the location of the NCBC in relation to the City of Gulfport and the Gulf of Mexico. The base occupies 1,100 acres with an average elevation of approximately 30 feet above sea level, with the only significant exception being two linear piles of bauxite stored on the surface. The bauxite piles are approximately 45 feet above the adjacent ground.

1.3 SITE HISTORY. Except as otherwise noted, the source for background information in this section is the *Summary Report, Remedial Characterization and Soil Remediation Technology Review for the Former Herbicide Storage Site at the Naval Construction Battalion Center, Gulfport, Mississippi* (U.S. Air Force [USAF], 1991).

Between 1968 and 1977, Site 8 at the NCBC was used by the USAF for the storage of HO. It was originally believed that approximately 12 acres of Site 8 was used for HO storage and that 850,000 gallons of HO were stored on this acreage. In 1986, two additional areas located outside the original acreage were identified and verified as sites of additional HO drum storage. The original (approximately 12 acres) site has been designated Site 8A, while the additional storage areas have been designated as Site 8B and Site 8C. Site 8B is approximately 17 acres and Site 8C is approximately 1 acre. Figure 1-2 shows the locations of Sites 8A, 8B, and 8C.

Prior to HO storage in about 1961, the Site 8A surface was stabilized with a soil/Portland cement mixture to provide a hardened surface for heavy equipment operation and storage.



**FIGURE 1-1
NCBC GULFPORT VICINITY MAP**

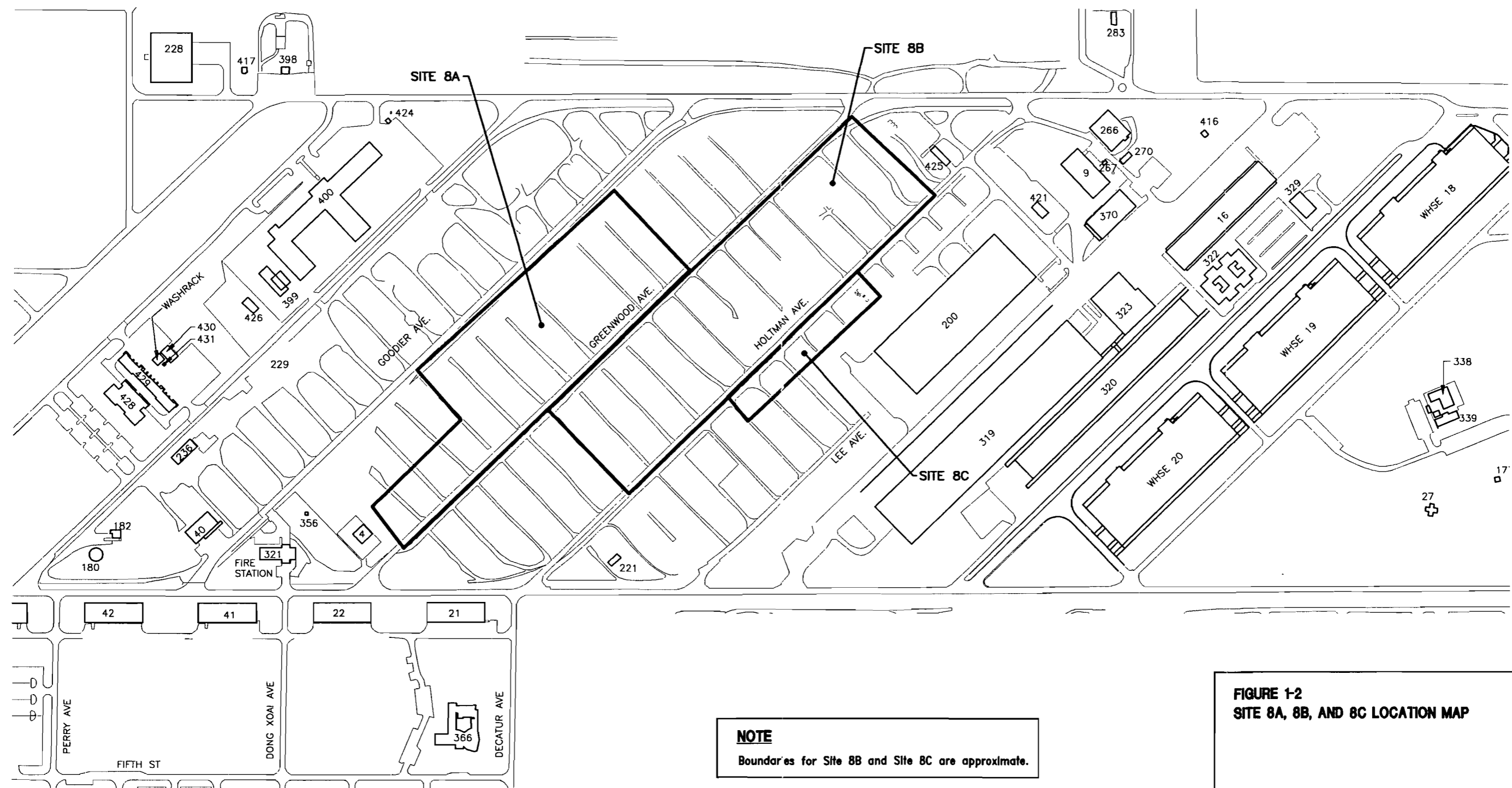
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NOTE
Boundaries for Site 8B and Site 8C are approximate.

FIGURE 1-2
SITE 8A, 8B, AND 8C LOCATION MAP



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**NAVAL CONSTRUCTION
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GULFPORT, MISSISSIPPI**

HO was developed as a defoliant for use in Vietnam. It is a liquid, with one gallon theoretically containing the following two active ingredients:

- 4.21 pounds of 2,4-dichlorophenoxyacetic acid (2,4-D)
- 4.41 pounds of 2,4,5-trichlorophenoxyacetic acid (2,4,5-T)

The compound 2,3,7,8-tetrachlordibenzo-p-dioxin (2,3,7,8-TCDD), commonly called TCDD or dioxin, was a contaminant in the 2,4,5-T. The average concentration of dioxin in the 850,000 gallons of HO stored at NCBC was about 2 parts per million.

In April 1970, the Secretaries of Agriculture; Health, Education, and Welfare; and the Interior jointly announced the suspension of certain uses of 2,4,5-T, based on studies indicating that 2,4,5-T was a teratogen. A teratogen is a substance capable of producing structural malformations (birth defects) in a developing fetus. Later studies identified TCDD as a toxic contaminant causing the teratogenic effects associated with 2,4,5-T. Following the 2,4,5-T suspension by the three Federal agencies, the Department of Defense (DOD) suspended the use of HO, because it contained 2,4,5-T. At the time of the suspension, the USAF had an inventory of 1.37 million gallons in South Vietnam and 850,000 gallons at NCBC. In September 1971, DOD directed that the HO in South Vietnam be returned to the United States and that the entire inventory (2.22 million gallons) be safely and efficiently disposed. In April 1972, the South Vietnam inventory was transported to Johnston Island in the Pacific Ocean. During the summer of 1977, the USAF disposed of the entire HO inventory by high temperature incineration at sea.

In 1986, the USAF began operations to clean up dioxin-contaminated soils at Site 8. The USAF obtained a Research, Development, and Demonstration (RD&D) permit from the United States Environmental Protection Agency (USEPA) Region IV in July 1986 to operate the ENSCO Corporation Mobile Waste Processor (MWP-2000) at the NCBC. The permit was granted contingent upon the results of pre-operation performance tests to ensure the incinerator could be operated within the performance requirements of USEPA's Resource Conservation and Recovery Act (RCRA) regulations. A verification test, using NCBC soil, was completed at Site 8 in December 1986. Following review of the verification test data, USEPA Region IV decided that a trial burn was needed to determine if RCRA requirements, including destruction and removal efficiency (DRE), could be met. Three trial burns were completed in May 1987. The feed stock for the trial burns was sand spiked with known concentrations of the chemical surrogates. In November 1987, USEPA Region IV provided approval to conduct full-scale treatment by incineration of the NCBC Site 8 soil. Full-scale incineration was successfully completed in 1988. The ash resulting from the incineration was stored on Site 8A (Versar, 1991). The ash met the RCRA DRE requirements and a dioxin concentration criterion of 1 part per billion (ppb) (Mississippi Department of Environmental Quality [MSDEQ], 1997a).

The source of the following information regarding the delisting of the Site 8A ash is *Addendum to Delisting Petition 0759, Area A, Former Herbicide Orange Storage Area, Naval Construction Battalion Center, Gulfport, Mississippi* (ABB Environmental Services, Inc. [ABB-ES], 1997a). The dioxin-contaminated soil at Site 8 was listed waste F027 per RCRA regulations. The ash resulting from the incineration was also listed waste F028 per RCRA regulations. In November 1988, the USAF submitted a delisting petition (Number 0759) to the USEPA, seeking to delist the ash as a hazardous waste. The first addendum to

petition 0759 was submitted in March 1989 and provided monthly data obtained during the period from August 1988 to the completion of the incineration project in November 1988. The USEPA recommended that the petition be denied based on concerns about concentrations of chlorinated dibenzo-p-dioxins, chlorinated dibenzo-p-furans, and polynuclear aromatics in the ash. The USEPA also raised concerns regarding leaching model results. The model was run using data from a single ash sample collected by a USEPA contractor. In response to the USEPA's action on the petition, the USAF submitted a draft Sampling and Analysis Plan (SAP) to collect additional data to support the delisting petition. Based on the USEPA's comments and concerns regarding the SAP, the Navy revised the SAP. The Navy contracted ABB-ES to implement the revised SAP. Minor modifications were suggested and approved in meetings with the USEPA and the MSDEQ. The State of Mississippi was granted delisting authority in May 1994. In August 1996, the Navy submitted the draft final addendum to delisting petition number 0759 (ABB-ES, 1996a) to the MSDEQ. By letter dated August 13, 1997, MSDEQ notified the Navy that, on July 27, 1997, MSDEQ approved the delisting petition (MSDEQ, 1997b).

Spills and leaks of HO occurred during the years of storage at Site 8. Dioxin has an affinity for soil and does not readily dissolve in water (see Subsection 2.4.1). Movement of dioxin from the storage area has occurred due to soil erosion. Areas 8A and 8B are drained by a system of ditches that drain to the northwestern corner of the NCBC. Over time, contaminated soil and sediment has been transported through the drainage system.

In addition to the ash from the Site 8 soil incineration, construction debris has been placed on Site 8A. An NCBC estimate of the volume of construction debris is 500 to 700 cubic yards (Crane, 1999). Site 8A also contains two sediment-handling areas. One sediment-handling area contains approximately 287 cubic yards of sediment and surface soil excavated in July 1995 during an interim removal action (ABB-ES, 1995a). The action was performed in and adjacent to three ditches along 28th Street on the north edge of the base. These three ditches are located at Outfall 1, Outfall 3, and Outfall 4 on the north side of the NCBC. Excavation occurred prior to personnel performing work in these ditches as part of city road widening and improvement actions along 28th Street. The action was taken to ensure that these workers would not be exposed to dioxin levels above the MSDEQ action level of 4.7 parts per trillion (ppt). It should be noted that, since this interim removal action was completed, site-specific risk-based remediation goals have been calculated and are used in this report (see Chapter 3.0). The second sediment-handling area contains an estimated 400 cubic yards of sediments excavated in the course of interim corrective measures conducted at the NCBC (Barrentine, 2000). These measures, completed by ABB-ES in October 1997, included the construction of two new sediment recovery traps (SRTs), the replacement of two existing SRTs, and the rehabilitation of one existing SRT within the on-base drainage ditch system (ABB-ES, 1998a).

There is swampland on the north side of 28th Street across from Outfall 3. Prior to 1995, surface water drainage exiting the base via Outfall 3 entered the swampland. In 1995, surface drainage exiting the base via Outfall 3 was rerouted so it no longer entered the swamp. The drainage was directed to the west to enter Canal No. 1. Water in Canal No. 1 flows to the north. The interim corrective measures, along with other existing SRTs significantly reduce off-site migration of dioxin-contaminated soil or sediment.

1.4 DEFINITIONS.

- Base. The base is the NCBC in Gulfport, Mississippi.
- Design consultant. The design consultant is the consultant who develops the final design for the remedial action, including the final design plans and specifications.
- Dioxin concentration. Dioxin concentration of a soil or sediment sample is considered the total toxic equivalent (TEQ) for dioxin-like compounds. Dioxin-like compounds are chlorinated dibenzodioxin and dibenzofuran congeners. The TEQ is obtained by multiplying the concentration of each congener by its toxicity equivalency factor (TEF) and summing the products, that is, $TEQ = \sum [(congener\ concentration) \times (TEF)]$.
- Dioxin-contaminated material. Dioxin-contaminated material is considered material with dioxin concentrations greater than or equal to the site-specific risk-based remediation goal for soil provided in Chapter 3.0.
- Covered area. For the purpose of this document, the term covered area will mean that part of Site 8A to which dioxin-contaminated materials will be brought, consolidated, and covered. Some part of Site 8A (for example, the railroad tracks) will probably not be part of the covered area.
- Remedial action contractor. The remedial action contractor (RAC) is the contractor who implements the remedial action in accordance with the final design plans and specifications.
- Sediment and soil. Sediment is solid material settled from suspension from a liquid. For the purposes of this report, sediment is considered material in drainage ditches or channels that is intermittently covered by water. Soil is material outside drainage ditches or channels that is virtually continuously exposed to the atmosphere. The FS should determine areas that are soil versus areas that are sediment. This report presents two volume estimates: one assuming that all material is sediment and should be remediated to the sediment cleanup level and one assuming that all material is soil and should be remediated to the soil cleanup level.

1.5 REMEDIAL STRATEGY. The remedial strategy consists of the following elements:

- Cutting any vegetation on Site 8A within 6 inches of the ground and removing and disposing of the vegetation.
- Spreading construction rubble that is already on Site 8A to a maximum thickness of 2 feet.
- Excavating and transporting dioxin-contaminated soil and sediment from on-base drainage ditches (including Site 8B drainage ditches) and the off-base swamp to Site 8A.

- Mixing the transported materials with ash at the covered area along with any other necessary amendments. Spreading the mixture on the site, covering construction rubble already spread on the covered area.
- Placing a subbase and a final cover over the dioxin-contaminated mixture to prevent contact with dioxin-contaminated material at Site 8A and to prevent migration of dioxin-contaminated material from Site 8A under normal use conditions. Land use restrictions will be necessary to ensure the areas remain industrial and prevent later residential use.

Different risk-based goals have been developed for soil and sediment (see Chapter 3.0). In areas where work changes or changes in the existing drainage system are likely, it is recommended that sediments be excavated to the soil remediation goal of 50 ppt.

A liner underneath contaminated material at Site 8A is not practical or necessary. It would be impractical to remove contaminated material from Site 8A in order to install a liner. A liner is not necessary because dioxin sorbed to particulate matter underneath the subbase and final cover has little potential for leaching (see Subsection 2.4.1) and the cover will prevent the infiltration of water necessary for any leaching to occur.

1.6 FUTURE CONSIDERATIONS. This document is the first step in providing remediation planning information to the Navy. The information and recommendations presented here are based on the best available information and may change based on the results of the FS and other potential actions. The FS results may alter the recommendations in this remediation planning document. Based on the FS, the excavation areas and volumes may change depending on areas determined to be soil versus areas determined to be sediment. Remediation plans for the swamp may be changed if the swamp becomes a Brownfield property under Mississippi regulations (MSDEQ, 1999).



2.0 SITE CHARACTERISTICS AND DATA

2.1 SURFACE WATER DRAINAGE SYSTEMS. The NCBC surface water drainage system consists of a system of drainage ditches. These drainage ditches have been determined to consist of six drainage areas (Harding Lawson Associates [HLA], 1999). These drainage areas are shown in Figure 2-1. The major part of Site 8A and a small part of Site 8B drain off-base via Drainage Area 1 (Figure 2-2). The remainder of Site 8B and a very small part of Site 8C drain off-base via Drainage Area 2 (Figure 2-3). Almost all of Site 8C drains off-base via Drainage Area 3 (Figure 2-4).

Drainage Areas 1 and 2 drain to the northwest corner of the base and exit base property at Outfall 3 (Figure 2-1). Drainage leaving the base at Outfall 3 runs underneath 28th Street. Base property ends on the south side of 28th Street. There is swampland on the north side of 28th Street across from Outfall 3. Prior to 1995, surface water drainage exiting the base via Outfall 3 entered the swampland. In 1995, surface drainage exiting the base via Outfall 3 was rerouted so it no longer entered the swamp. The drainage was directed to the west to enter Canal No. 1. Water in Canal No. 1 flows to the north.

Typically, many of the on-base drainage ditches are continually filled with water. Some of the drainage ditches are dry for some part of the year.

Approximately the southernmost 2,000 feet of the swamp has a distinct drainage channel. North (downgradient) of this area there is no distinct drainage channel in the swamp. The swamp drainage channel is not continuously covered by water.

2.2 TOPOGRAPHIC MAP OF SITE 8. On January 10, 2000, HLA supervised an aerial (photogrammetric) survey of Site 8. Appendix A provides the 1-foot contour interval map produced from the aerial survey. The areas of relatively large elevation changes within Site 8A are primarily due to ash piles resulting from the incineration of dioxin-containing soils as described in Section 1.3. Construction rubble accounts for some of the areas of elevation change.


2.3 PHYSICAL DATA. On December 6 through December 10, 1999, HLA supervised the drilling of 22 soil borings on Site 8A, Site 8B, and the area to the northeast of Site 8A. Figure 2-5 shows the locations of these borings. Standard Penetration Test (SPT) (American Society for Testing and Materials [ASTM] D1556) results were recorded. California Bearing Ratio (CBR) Testing (ASTM D1883) was conducted on soil from Boring GB09. On December 8 and 9, HLA collected samples from 8 on-base ditches (GS-1 through GS-8) and 12 locations in the swamp (GS-9 through GS-20). Figures 2-6 and 2-7 provide the approximate locations of the on-base and swamp samples, respectively. Mechanical grain-size analyses in accordance with ASTM D422 and Atterberg limit testing (ASTM D4318) were conducted on the following:

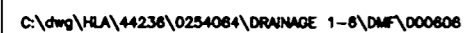
- Seven samples from the Sites 8A and 8B soil borings
- Two composite samples from the Site 8A ash piles
- On-base ditch samples GS-1 through GS-8
- Swamp samples GS-9 through GS-20

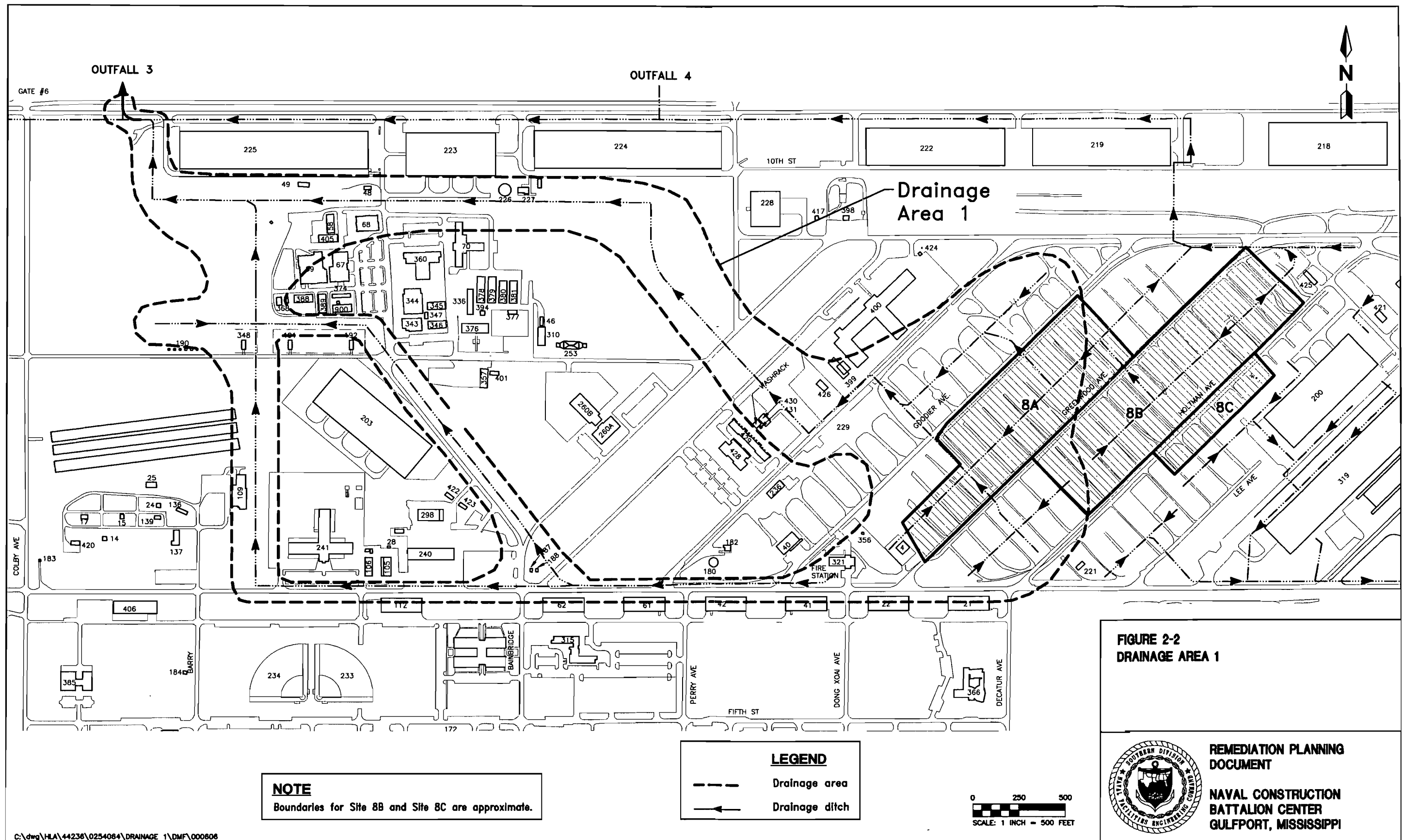
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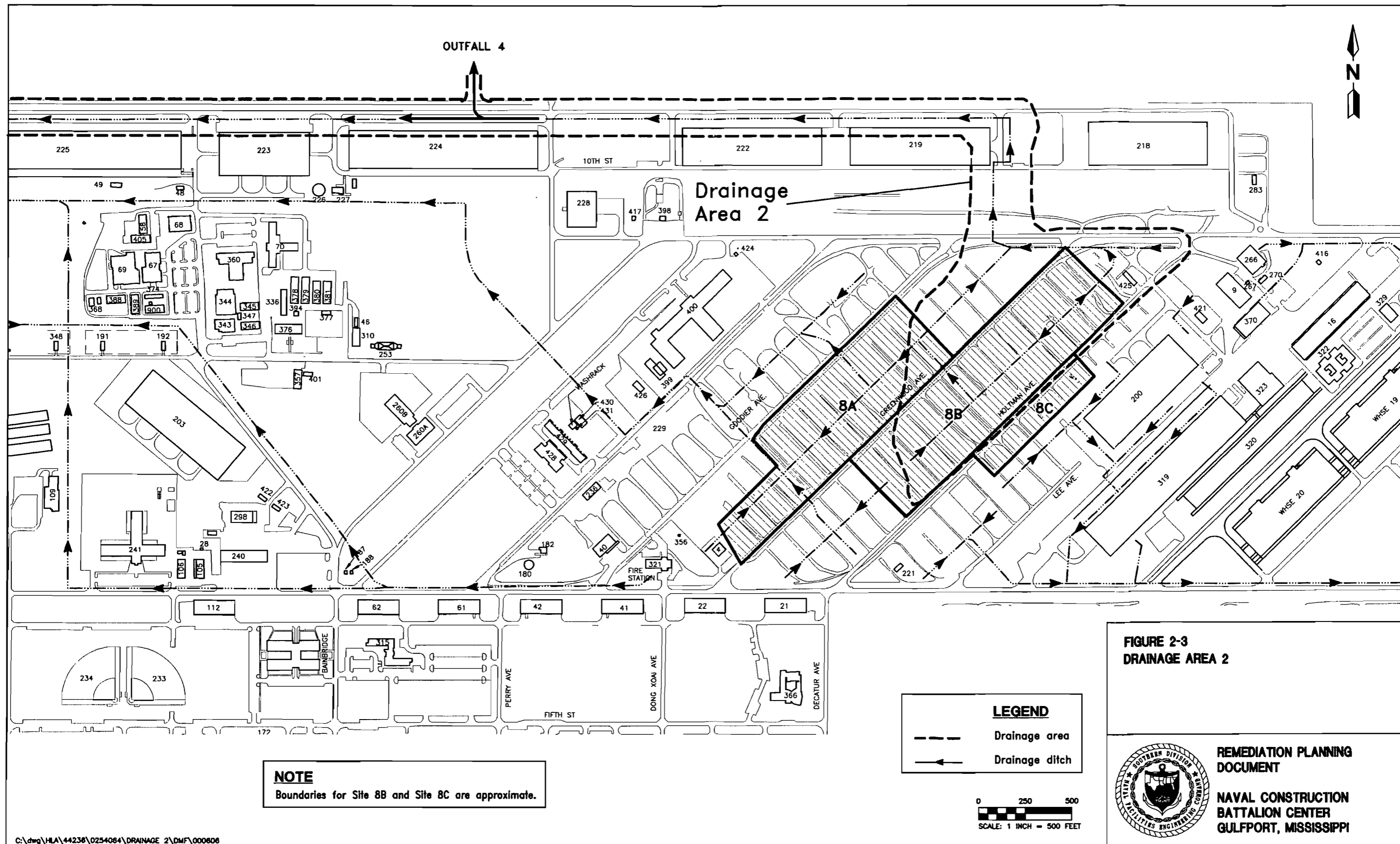


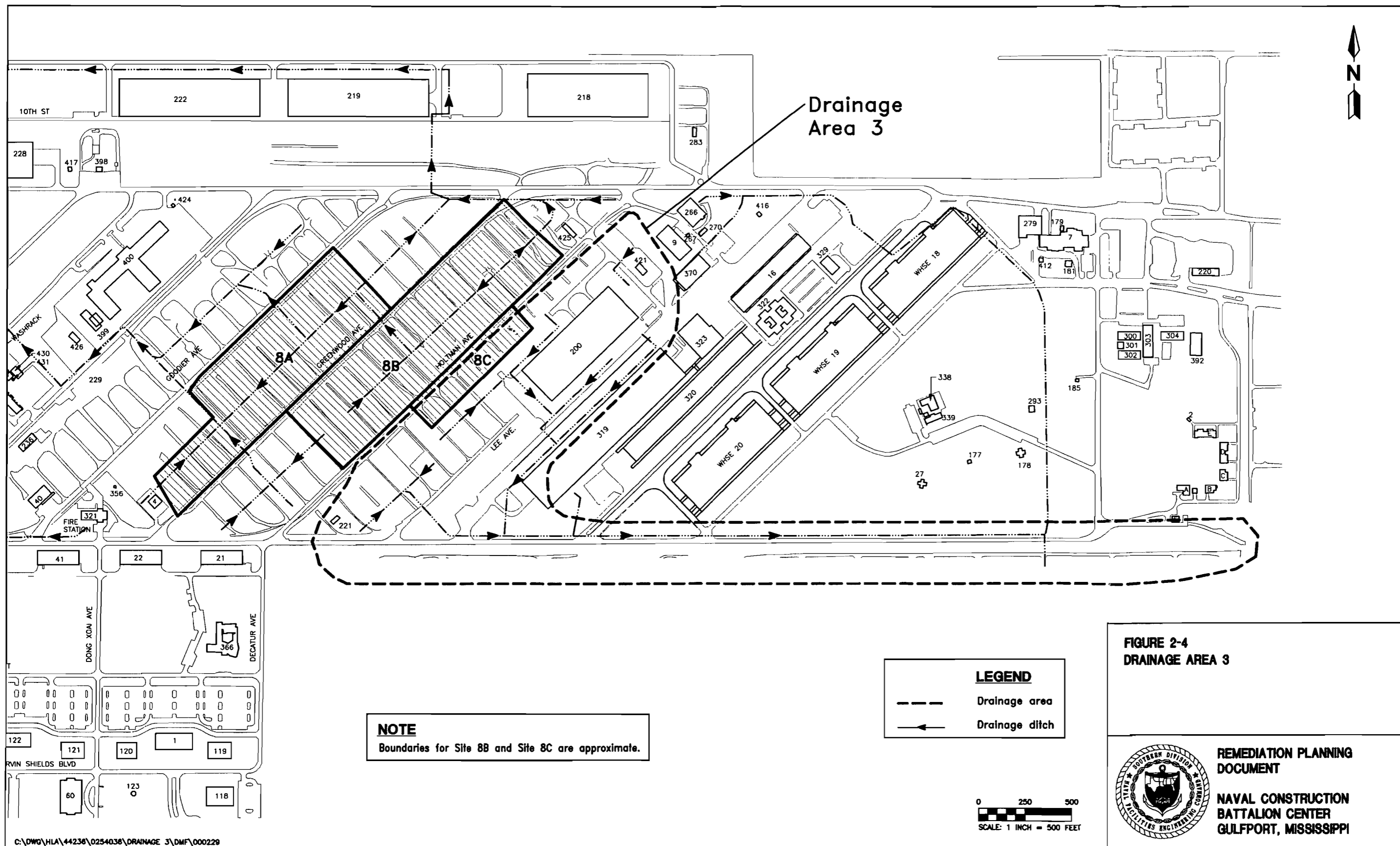
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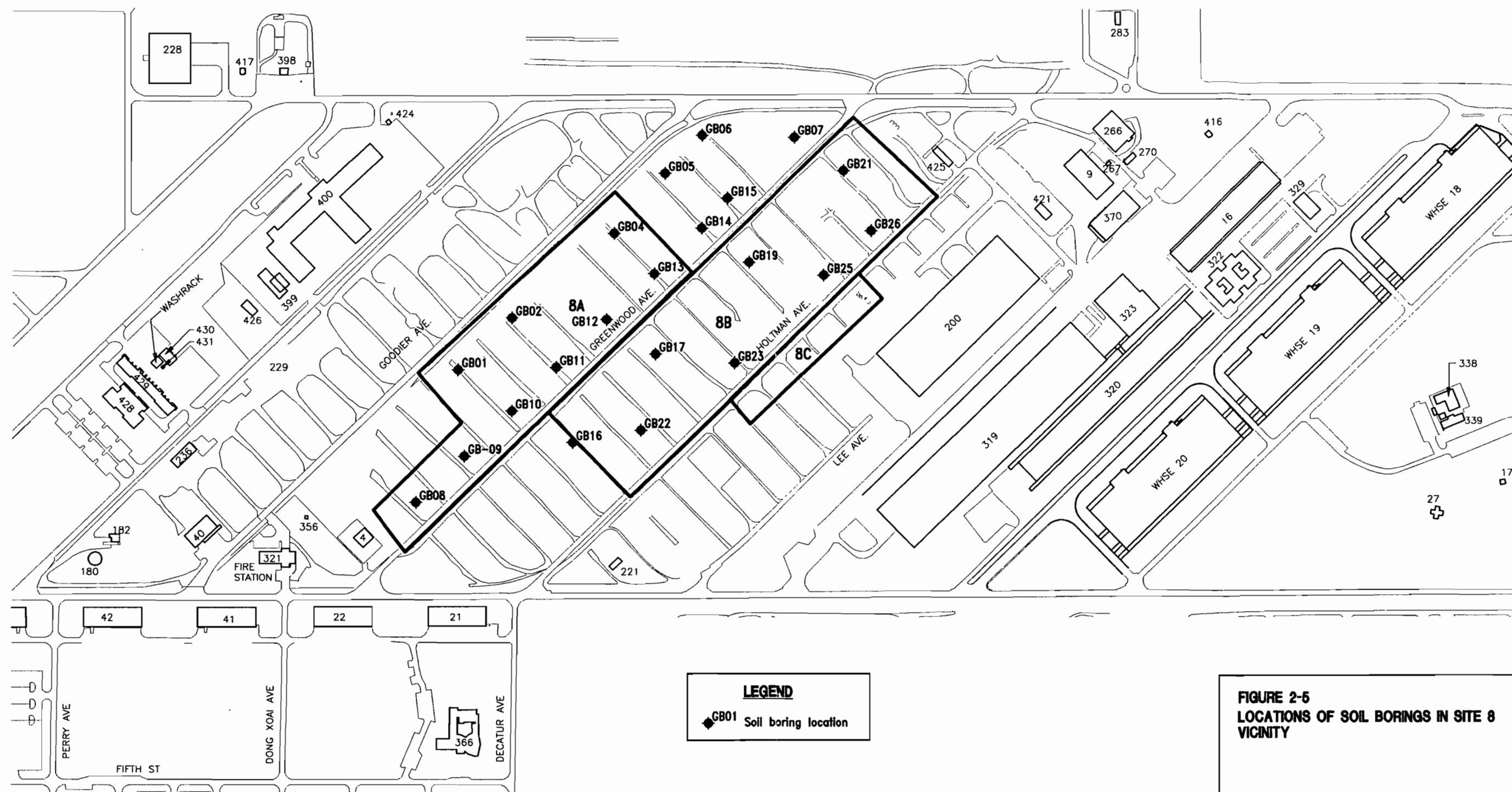
 Drainage area
 Drainage ditch











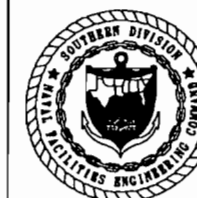
LEGEND

◆ GB01 Soil boring location

NOTES

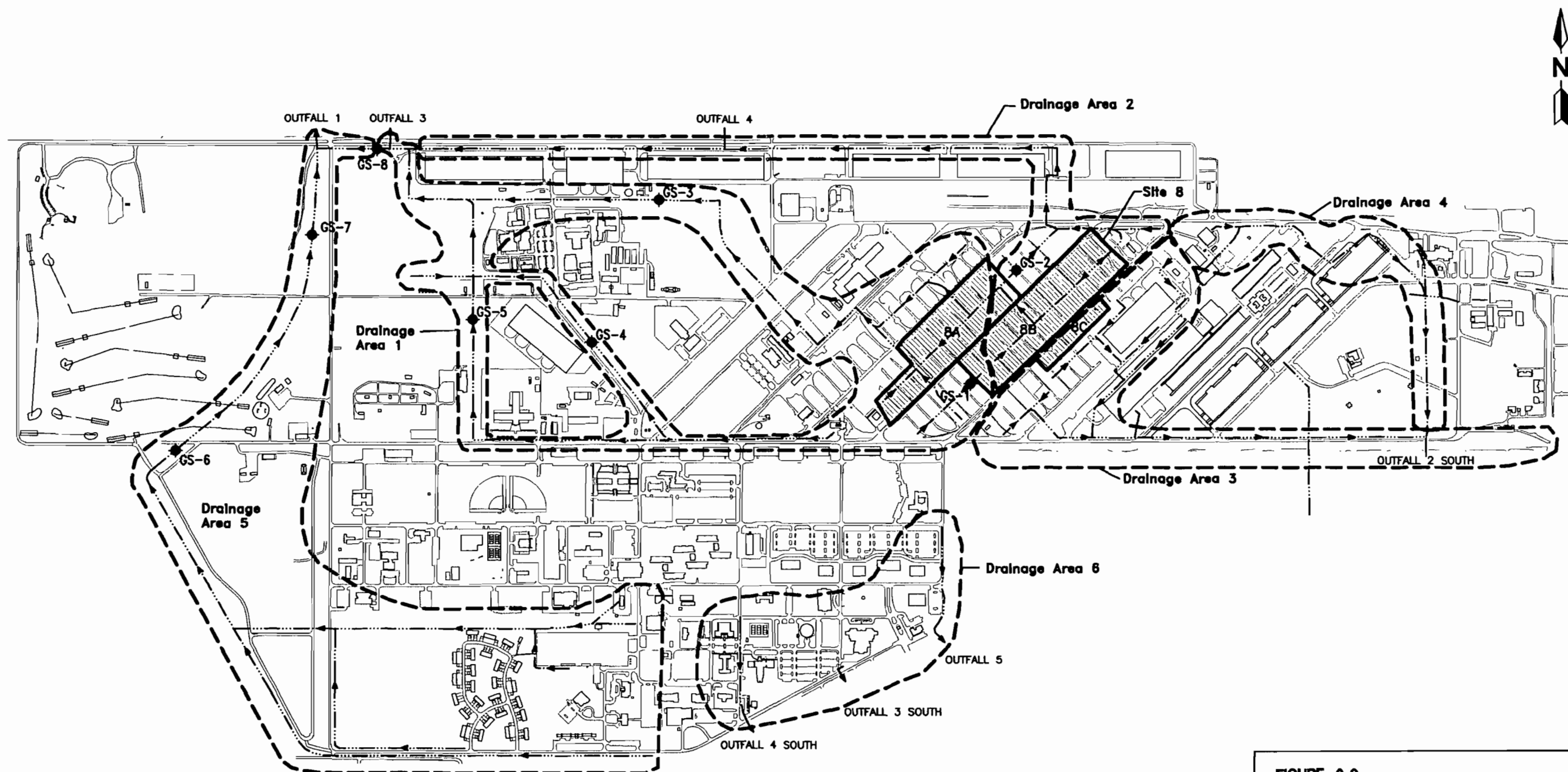
1. Boring logs are provided in Appendix B. Soil Boring Investigation: December 6-10, 1999
2. Boundaries for Site 8B and Site 8C are approximate.

**FIGURE 2-5
LOCATIONS OF SOIL BORINGS IN SITE 8
VICINITY**



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DOCUMENT**

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NOTES

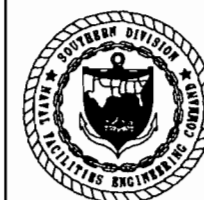
1. Locations for geotechnical samples are approximate.
2. Sampling dates were December 8-9, 1999.
3. Boundaries for Site 8B and Site 8C are approximate.

LEGEND

- Drainage area
- Drainage ditch
- ◆ GS-1 Geotechnical sample location

0 500 1000
SCALE: 1 INCH = 1000 FEET

FIGURE 2-6
ON-BASE GEOTECHNICAL SAMPLING LOCATIONS



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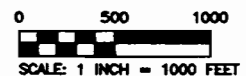
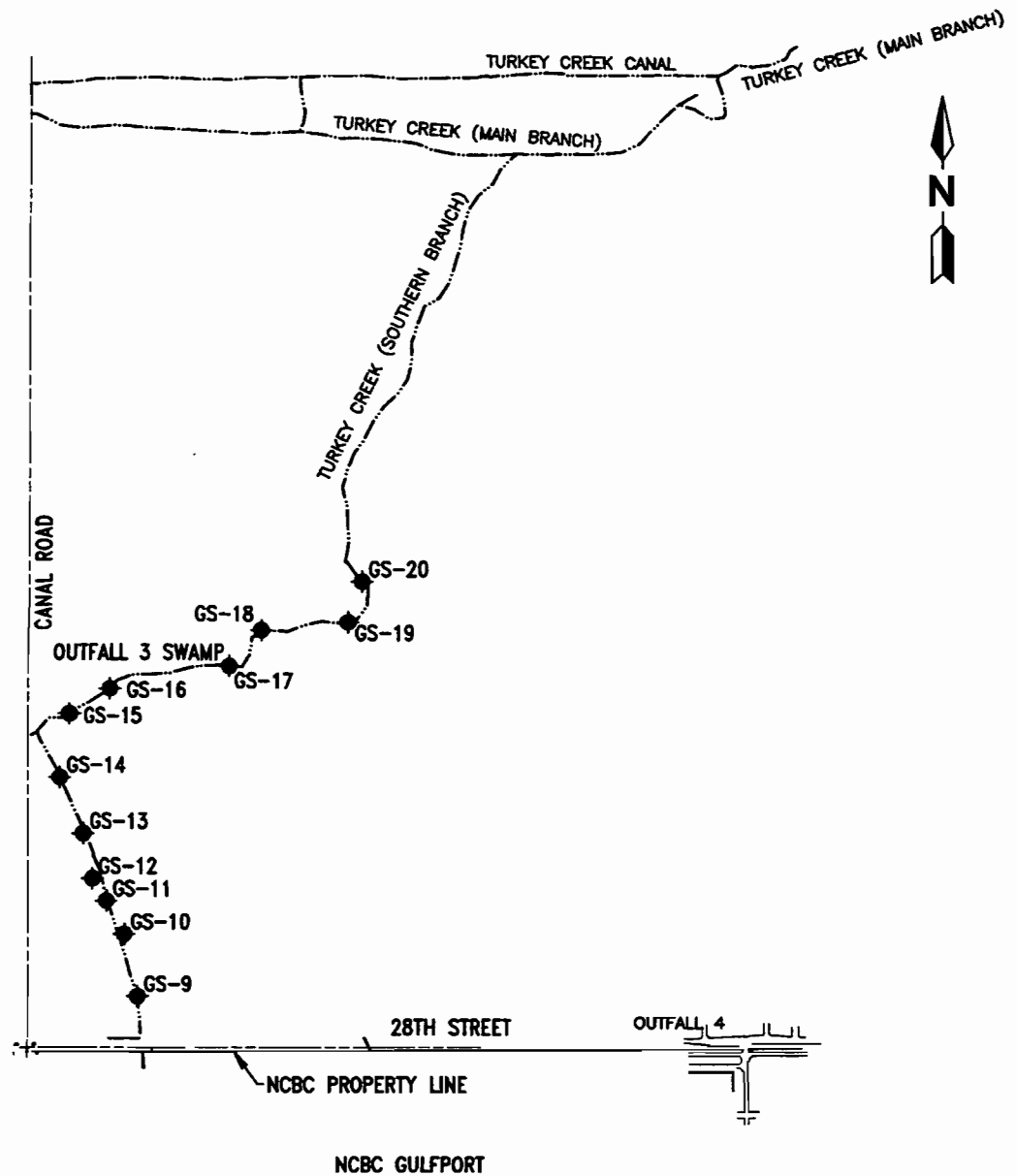


FIGURE 2-7
SWAMP GEOTECHNICAL SAMPLING LOCATIONS



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C:\dwg\HLA\44236\0254064\SWAMPGEOTECHSPLES\DMF\000606

Table 2-1 summarizes the SPT results and includes the boring identification number, depth interval, relative density, and United Soil Classification System (USCS) classification (based on field observations and laboratory test results). Table 2-2 summarizes the results of grain-size analyses and Atterberg limit testing, as well as the American Association of State Highway Transportation Officials (AASHTO) classification and the general subgrade rating based on the AASHTO rating system (Portland Cement Association [PCA], 1992). Results of the analyses indicate that the proposed remedial action is feasible.

Appendix B provides the following:

- Soil boring logs, including SPT results;
- CBR test results;
- Grain-size analyses and Atterberg limit results; and
- A copy of the chain of custody record.

2.4 CONCEPTUAL SITE MODEL.

2.4.1 Chemical Characteristics of Dioxin Dioxin has a high octanol-water partition coefficient (K_{ow}) and a very low solubility. For 2,3,7,8-TCDD, K_{ow} is $10^{6.80}$ and the solubility is 0.0000193 gram per cubic meter (Mackay, 1991). This combination of characteristics means that in soil, sediment, and the water column dioxin is primarily associated with particulate and organic matter. Dioxin exhibits little potential for significant leaching or volatilization once sorbed to particulate matter (U.S. Environmental Protection Agency [USEPA], 1994).

2.4.2 Original Contaminant Source and Migration from Source The original contaminant source was dioxin-contaminated soils on Sites 8A, 8B, and 8C. These contaminated soils were the result of spills and leaks from the storage of HO from 1968 to 1977. Storage was discontinued in 1977 when the HO drums were removed from the base. From 1986 to 1988, contaminated soils from Sites 8A, 8B, and 8C were incinerated and the resulting ash remains on Site 8A.

Movement of dioxin-contaminated soils from Sites 8A, 8B, and 8C has occurred both during and after the HO storage period. Movement has primarily been attributed to soil erosion by surface water runoff. Site 8A is the major remaining source for additional dioxin-contaminated materials migrating through the base drainage system.

2.4.3 On-Base Drainage Ditches Section 2.1 describes the NCBC surface water drainage ditch system. As discussed in Section 2.1, the major part of Site 8A and a small part of Site 8B drain off-base via Drainage Area 1 (Figure 2-2). The remainder of Site 8B and a very small part of Site 8C drain off-base via Drainage Area 2 (Figure 2-3). Almost all of Site 8C drains off-base via Drainage Area 3 (Figure 2-4).

Erosion by surface water runoff has moved contaminated soil into the drainage ditches. Due to the affinity of dioxin for particulate and organic matter, dioxin does not significantly dissolve in water. Water flow in the ditches

Table 2-1
Geotechnical Testing Results Summary - SPT, Relative Density, and USCS
Sampling Dates: December 6 - 10, 1999

Remediation Planning Document
Naval Construction Battalion Center
Gulfport, Mississippi

ID	Location	Depth (ft bls)	SPT value (blow count)	Relative Density ¹	USCS Observed	USCS Lab ²
GB01	8A	0 to 1.5	9	Loose	SM	SM
		4.5 to 6	24	Medium dense	SP/SM	N/A
		9 to 10.5	8	Loose	SP/SM, SP	N/A
		13.5 to 15	21	Medium dense	SP	N/A
GB02	8A	0 to 2	7	Loose	SP	N/A
		2 to 4	18	Medium dense	SP	N/A
		4 to 6	12	Medium dense	SP	N/A
		6 to 8	12	Medium dense	SP	N/A
		8 to 10	10	Loose/medium dense	SP	N/A
		10 to 12	9	Loose	SP	N/A
		12 to 14	11	Medium dense	SP	N/A
		14 to 16	12	Medium dense	SP	N/A
GB04	8A	0 to 1.5	17	Medium dense	SM	N/A
		4.5 to 6	13	Medium dense	SW,SM	N/A
		9 to 10.5	18	Medium dense	SP	N/A
		13.5 to 15	15	Medium dense	SP	N/A
GB05	8A ²	0 to 2	9	Loose	SP	N/A
		2 to 4	21	Medium dense	SP	N/A
		4 to 6	29	Medium dense	SP	N/A
		6 to 8	25	Medium dense	SP,SM	N/A
		8 to 10	14	Medium dense	SM	N/A
		10 to 12	7	Loose	SM	N/A
		12 to 14	30	Medium dense/dense	SP	N/A
		14 to 16	19	Medium dense	SP	N/A
GB06	8A ²	0 to 1.5	5	Loose	SM,ML	N/A
		4.5 to 6	5	Loose	ML	N/A
		9 to 10.5	25	Medium dense	SW	N/A
		13.5 to 15	18	Medium dense	SP	N/A
GB07	8A ²	0 to 1.5	24	Medium dense	SP	N/A
		4.5 to 6	9	Loose	SP	N/A
		9 to 10.5	18	Medium dense	SP	N/A
		13.5 to 15	25	Medium dense	SP	N/A

See notes at end of table.

Table 2-1 (Continued)
Geotechnical Testing Results Summary - SPT, Relative Density, and USCS
Sampling Dates: December 6 - 10, 1999

Remediation Planning Document
Naval Construction Battalion Center
Gulfport, Mississippi

ID	Location	Depth (ft bls)	SPT value (blow count)	Relative Density ¹	USCS Observed	USCS Lab
GB08	8A	0 to 2	10	Loose/ medium dense	SM	N/A
		2 to 4	9	Loose	SM,SP	SP
		4 to 6	14	Medium dense	SP	N/A
		6 to 8	18	Medium dense	SP	N/A
		8 to 10	15	Medium dense	SP,SM	N/A
		10 to 12	20	Medium dense	SP	SP
		12 to 14	32	Dense	SP	N/A
		14 to 16	24	Medium dense	SP	N/A
GB09	8A	0 to 1.5	8	Loose	SP	N/A
		4.5 to 6	11	Medium dense	SP	N/A
		9 to 10.5	20	Medium dense	SP	N/A
		13.5 to 15	12	Medium dense	SP	N/A
GB10	8A	0 to 1.5	7	Loose	SP	N/A
		4.5 to 6	21	Medium dense	SP	N/A
		9 to 10.5	21	Medium dense	SP	N/A
		13.5 to 15	30	Medium dense/dense	SP	N/A
GB11	8A	0 to 1.5	14	Medium dense	SP	N/A
		4.5 to 6	7	Loose	SP	N/A
		9 to 10.5	17	Medium dense	SP	N/A
		13.5 to 15	28	Medium dense	SP	N/A
GB12	8A	0 to 1.5	4	Loose	SM,SP	N/A
		4.5 to 6	16	Medium dense	SP	SP
		9 to 10.5	15	Medium dense	SP	N/A
		13.5 to 15	21	Medium dense	SP	N/A
GB13	8A	0 to 1.5	6	Loose	SM	N/A
		4.5 to 6	17	Medium dense	SP	N/A
		9 to 10.5	22	Medium dense	SM	N/A
		13.5 to 15	23	Medium dense	SP	SP
GB14	8A ²	0 to 1.5	9	Loose	SP,SM	N/A
		4.5 to 6	10	Loose/ medium dense	SM	N/A
		9 to 10.5	9	Loose	SP	N/A
		13.5 to 15	25	Medium dense	SP,SM	N/A

See notes at end of table.

Table 2-1 (Continued)
Geotechnical Testing Results Summary - SPT, Relative Density, and USCS
Sampling Dates: December 6 - 10, 1999

Remediation Planning Document
Naval Construction Battalion Center
Gulfport, Mississippi

ID	Location	Depth (ft bls)	SPT value (blow count)	Relative Density ¹	USCS Observed	USCS Lab
GB15	8A ²	0 to 1.5	8	Loose	ML	N/A
		4.5 to 6	15	Medium dense	SM	N/A
		9 to 10.5	25	Medium dense	SP	N/A
		13.5 to 15	22	Medium dense	SP	N/A
GB16	8B	0 to 2	12	Medium dense	SP	N/A
		2 to 4	13	Medium dense	SC,SP	N/A
		4 to 6	24	Medium dense	SP	N/A
		6 to 8	25	Medium dense	SP,SM	N/A
		8 to 10	4	Loose	SM,SP	SP
		10 to 12	17	Medium dense	SM	N/A
		12 to 14	not recorded		SM	N/A
		14 to 16	16	Medium dense	SW,SP	N/A
GB17	8B	0 to 1.5	13	Medium dense	ML	N/A
		4.5 to 6	12	Medium dense	SP	N/A
		9 to 10.5	16	Medium dense	SM	N/A
		13.5 to 15	12	Medium dense	SM	N/A
GB19	8B	0 to 1.5	12	Medium dense	ML,SM	N/A
		4.5 to 6	15	Medium dense	SM,SP,SM	N/A
		9 to 10.5	20	Medium dense	SM	N/A
		13.5 to 15	17	Medium dense	SM	N/A
GB21	8B	0 to 2	15	Medium dense	ML,SM	N/A
		2 to 4	12	Medium dense	SM	N/A
		4 to 6	16	Medium dense	SM	N/A
		6 to 8	26	Medium dense	SW	SP
		8 to 10	20	Medium dense	SM	N/A
		10 to 12	16	Medium dense	SP,SM	N/A
		12 to 14	25	Medium dense	SP,ML	N/A
		14 to 16	43	Dense	SP,ML	N/A
GB22	8B	0 to 1.5	11	Medium dense	ML,SC	N/A
		4.5 to 6	15	Medium dense	SP	N/A
		9 to 10.5	9	Loose	SM	N/A
		13.5 to 15	18	Medium dense	SM	N/A
See notes at end of table.						

Table 2-1 (Continued)
Geotechnical Testing Results Summary - SPT, Relative Density, and USCS
Sampling Dates: December 6 - 10, 1999

Remediation Planning Document
Naval Construction Battalion Center
Gulfport, Mississippi

ID	Location	Depth (ft bls)	SPT value (blow count)	Relative Density ¹	USCS Observed	USCS Lab
GB23	8B	0 to 1.5	20	Medium dense	ML,SM	N/A
		4.5 to 6	15	Medium dense	SP	N/A
		9 to 10.5	19	Medium dense	SP	N/A
		13.5 to 15	7	Loose	SW	N/A
GB25	8B	0 to 1.5	18	Medium dense	ML,SM	N/A
		4.5 to 6	33	Dense	SP	N/A
		9 to 10.5	13	Medium dense	SM	N/A
		13.5 to 15	16	Medium dense	SP	N/A
GB26	8B	0 to 1.5	18	Medium dense	SP	N/A
		4.5 to 6	10	Loose/medium dense	SP	N/A
		9 to 10.5	13	Medium dense	SM,SP	N/A
		13.5 to 15	13	Medium dense	SW	N/A

Notes: SPT = Standard Penetration Test.
USCS = Unified Soil Classification System. Classifications used in this table are:
SP = poorly graded sands, gravelly sands, little or no fines.
SM = silty sands, sand-silt mixtures.
ML = silty or clayey fine-grained sands or clayey silts.
SC = clayey sands, sands-clay mixtures.
SW = well-graded sands, gravelly sands, little or no fines.
N/A = not analyzed by the laboratory.
ID = identification.
ft bls = feet below land surface.

¹ Reference: American Society for Testing and Materials. Standard Test Method for Penetration Test and Split-Barrel Sampling of Soil. D1586-67 (1974).

² The area directly to the northeast of Site 8A, inside the railroad tracks.

Table 2-2
Geotechnical Results Summary - Grain Size Analysis, Atterberg Limits, and AASHTO Classification
(Sampling Dates: December 6 - 10, 1999)

Remediation Planning Document
 Naval Construction Battalion Center
 Gulfport, Mississippi

Sample ID, Interval (feet)	Location	Grain Size Analysis			Granular or Silt-Clay Material ¹	Atterberg Limits			AASHTO Class ¹	General Subgrade Rating ¹
		% Passing No. 10 Sieve	% Passing No. 40 Sieve	% Passing No. 200 Sieve		Liquid Limit	Plastic Limit	Plasticity Index		
GB01, 0-1.5	8A	100	95	18.2	Granular	19	16	3	A-2-4	Excellent to good
GB08, 2-4	8A	100	86	2.1	Granular	NP	NP	NP	A-3	Excellent to good
GB12, 4.5-6	8A	99.9	86.7	2.9	Granular	NP	NP	NP	A-3	Excellent to good
GB13, 13.5-15	8A	98	77.2	2.7	Granular	NP	NP	NP	A-3	Excellent to good
GB08, 10-12	8A	94.1	78.6	2.2	Granular	NP	NP	NP	A-3	Excellent to good
GB16, 8-10	8B	99	57.4	2.5	Granular	NP	NP	NP	A-3	Excellent to good
GB21, 6-8	8B	98.9	75.8	2.3	Granular	NP	NP	NP	A-3	Excellent to good
ASH-1	8A	86.1	67.6	12.9	Granular	NP	NP	NP	*	*
ASH-2	8A	94.7	76	10.2	Granular	NP	NP	NP	*	*
GS-1	On-base ditch	96.6	77.1	13.7	Granular	25	24	1	A-2-4	Excellent to good
GS-2	On-base ditch	95.7	88.6	31.7	Granular	52	30	22	A-2-7	Fair to poor
GS-3	On-base ditch	99.6	99.4	95.6	Silt-clay	47	25	22	A-7-6	Fair to poor
GS-4	On-base ditch	99.1	81.3	16.9	Granular	NP	NP	NP	*	*
GS-5	On-base ditch	99.6	95	22.2	Granular	17	15	2	A-2-4	Excellent to good
GS-6	On-base ditch	99.9	81.4	27	Granular	17	15	2	A-2-4	Excellent to good
GS-7	On-base ditch	99.9	97	27.4	Granular	27	20	7	A-2-4	Excellent to good
GS-8	On-base ditch	99.9	98.9	31.8	Granular	25	20	5	A-2-4	Excellent to good
GS-9	Swamp	98.7	95.3	77.8	Silt-clay	61	35	26	A-7-5	Fair to poor
GS-10	Swamp	99.8	98.8	70.3	Silt-clay	48	29	19	A-7-6	Fair to poor
GS-11	Swamp	99.3	93.3	65.6	Silt-clay	75	38	37	A-7-5	Fair to poor
GS-12	Swamp	100	99.2	44.2	Silt-clay	21	18	3	A-4	Fair to poor
GS-13	Swamp	97.3	91	73.7	Silt-clay	95	52	43	A-7-5	Fair to poor
GS-14	Swamp	98.2	89.7	27	Granular	39	26	13	A-2-6	Fair to poor
GS-15	Swamp	99.9	98.4	63	Silt-clay	49	28	21	A-7-6	Fair to poor
GS-16	Swamp	99.8	98.2	68.2	Silt-clay	62	33	29	A-7-5	Fair to poor
GS-17	Swamp	99.2	95.9	26.3	Granular	20	18	2	A-2-4	Excellent to good
GS-18	Swamp	99.8	66	22.6	Granular	27	22	5	A-2-4	Excellent to good
GS-19	Swamp	93.8	66.7	61.9	Silt-clay	94	44	50	A-7-5	Fair to poor
GS-20	Swamp	99.9	97.8	35.8	Silt-clay	33	20	13	**	**

See notes at end of table.

Table 2-2 (Continued)
Geotechnical Results Summary - Grain Size Analysis, Atterberg Limits, and AASHTO Classification
(Sampling Dates: December 6 - 10, 1999)

Remediation Planning Document
Naval Construction Battalion Center
Gulfport, Mississippi

¹ Reference: Portland Cement Association (PCA). 1992. PCA Soil Primer. Skokie, IL

Notes: AASHTO = American Association of State Highway Transportation Officials

ID = identification.

% = percent.

NP = Non-plastic

* = Non-plastic, but percent passing No. 200 sieve exceeds 10; therefore, this sample does not appear to match any AASHTO classification.

** = Does not match any AASHTO category for clay-silt materials.

has transported the dioxin-contaminated material downstream in the ditches. The material eventually settles and forms sediment in the bottom of the drainage ditches. Storm events have both added additional contaminated materials to the drainage ditches and increased flow in the drainage ditches. Increased flows in the drainage ditches serves to suspend sediment and transport it further downstream. Deposition of sediment theoretically should occur in areas of energy reduction, such as turns in a drainage ditch; however, sampling results do not always support this theory. It is believed that contaminated sediments have been deposited in the ditches and not generally outside the edges of the ditches.

Dioxin TEQ results indicate that dioxin has primarily migrated throughout the base drainage ditches in Drainage Areas 1, 2, and to a lesser extent, 3.

2.4.4 Swamp Drainage Areas 1 and 2 drain to the northwest corner of the base and exit base property at Outfall 3 (Figure 2-1). Drainage leaving the base at Outfall 3 runs underneath 28th Street. Base property ends on the south side of 28th Street. There is swampland on the north side of 28th Street across from Outfall 3. Prior to 1995, surface water drainage exiting the base via Outfall 3 entered the swampland. This drainage transported dioxin-contaminated sediments into the swamp. Surface water flow through the swamp moved dioxin-contaminated sediments downgradient. Dioxin-contaminated sediment was also deposited outside the banks of the channel as a result of high flow conditions when the water overflowed the channel banks. This deposition occurred along approximately the southernmost 2,000 feet of drainage in the swamp, where there is a distinct drainage channel. North (downgradient) of this area there is no distinct drainage channel, but a similar transport mechanism occurs in this area.

In 1995, surface drainage exiting the base via Outfall 3 was rerouted so it no longer entered the swamp. The drainage was directed to the west to enter Canal No. 1. Water in Canal No. 1 flows to the north. Therefore, since 1995, the base has not been a source of additional dioxin-contaminated sediment for the swamp. Rain falling on the swamp may continue to transport existing dioxin-contaminated sediment downstream or outside the drainage channel. The swamp drainage channel is not continuously covered by water; therefore, there is not continuous transport by water flowing through the swamp.

2.4.5 Sites 8B and 8C Sampling results indicate that the Site 8B drainage ditches are a potential source contributing to dioxin migration. Sites 8B and 8C soils do not appear to be major potential sources of contaminant migration. The FS should further investigate areas in 8B and 8C where previous sampling found soil concentrations exceeding the risk-based remedial goal. Depending on the results of the FS, additional excavation may be required from Sites 8B and 8C to remove potential sources of dioxin contamination.

2.4.6 Other Areas Other potential areas of contamination are in the vicinity of Outfall 1 (Canal No. 1) and Outfall 4 (See Figure 2-1). Sediments with dioxin concentrations exceeding 4.7 ppt were excavated from these areas and placed on Site 8A in July 1995 (ABB-ES, 1995a). These actions were part of the 28th Street interim removal action described in Section 1.3.

In April 1997, sediment/soil samples were collected from Canal No. 1 downgradient from the NCBC and from the drainage ditch downgradient of Outfall 4. Total dioxin TEQ results for these samples were all below 15.5 ppt

(ABB-ES, 1998b). In October 1997, ABB-ES completed interim corrective measures at the NCBC. The interim corrective measures included the construction of two new SRTs, the replacement of two existing SRTs, and the rehabilitation of one existing SRT within the on-base drainage ditch system (ABB-ES, 1998a). The interim corrective measures, along with other existing SRTs significantly reduce off-site migration of dioxin-contaminated soil or sediment from Outfall 1 and Outfall 4. Dioxin concentrations less than the site-specific risk-based remediation goals (see Chapter 3.0) and the presence of working SRTs indicate that further excavation is not warranted from Canal No. 1 or the Outfall 4 drainage ditch.



3.0 RISK-BASED REMEDIATION GOALS

3.1 CALCULATED REMEDIATION LEVELS. Site-specific risk-based remediation goals were calculated for soil and sediment based on identified potential receptor populations and risk assessment methodology. The purpose of site-specific remediation goals is to define an acceptable risk-based concentration for excavation areas; that is, excavation is to continue in an area until dioxin concentrations in the remaining material are less than the applicable remediation goal.

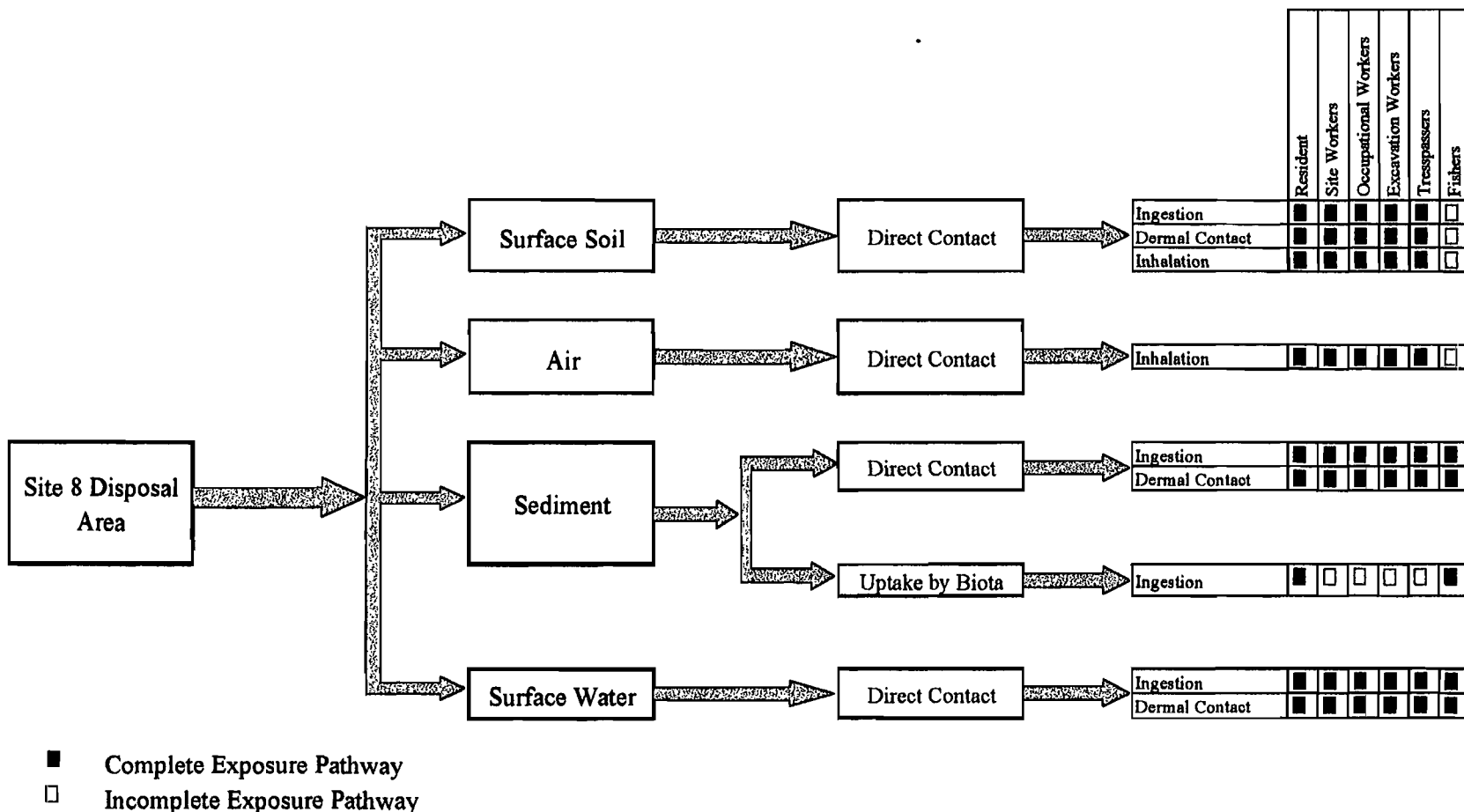
The process of calculating remediation levels consist of the three following basic steps.

- Determining potential pathways and receptors for each potential exposure scenario. One example would be dermal absorption of contaminated soil by excavation workers at a site used for partially restricted industrial development. In this case, dermal absorption of soil would be the potential pathway, excavation workers would be the receptors, and partially restricted industrial development would be the exposure scenario.
- Determining appropriate values for the parameters that are applicable to the potential pathway, receptor, and exposure scenario. For example, for dermal absorption, parameters include the dermal cancer slope factor, skin surface area, skin adherence factor, and body weight.
- Calculating the remediation levels applicable to each receptor for each exposure scenario by using the appropriate parameters in the risk-based remediation level equation. The calculated remediation levels account for all exposure routes (ingestion, inhalation, and dermal contact) for each receptor.

Site conceptual models were used as a tool to define potential pathways and receptors. The demographics at NCBC Gulfport were evaluated during the Community Survey and Exposure Assessment (CSEA) (ABB-ES, 1997b). The CSEA identified six different receptors at NCBC. They were on-base residents, off-base residents, on-base workers, off-base workers, trespassers, and fishers. Two site conceptual models were developed that summarize the potential exposure pathways by which people could be exposed to contamination detected in the various exposure media. One model was developed for on-base receptors (Figure 3-1), the other for off-base receptors (Figure 3-2).

Based on the site-conceptual model and discussions with MSDEQ, an approach was developed that evaluated each of the receptors that could come into contact with surface soil or sediment under three different exposure scenarios. Fishers were evaluated by the trespasser receptor. The same receptors and exposure scenarios apply to both on-base and off-base soils and sediments. In these exposure scenarios, the term "restricted" means restricted access to the contaminated media. The three exposure scenarios are listed below.

- Exposure Scenario I: Unrestricted Residential Development. The area is developed as residential housing. There is unlimited surface soil exposure for all age groups. Off-base residents are assumed to live in the same

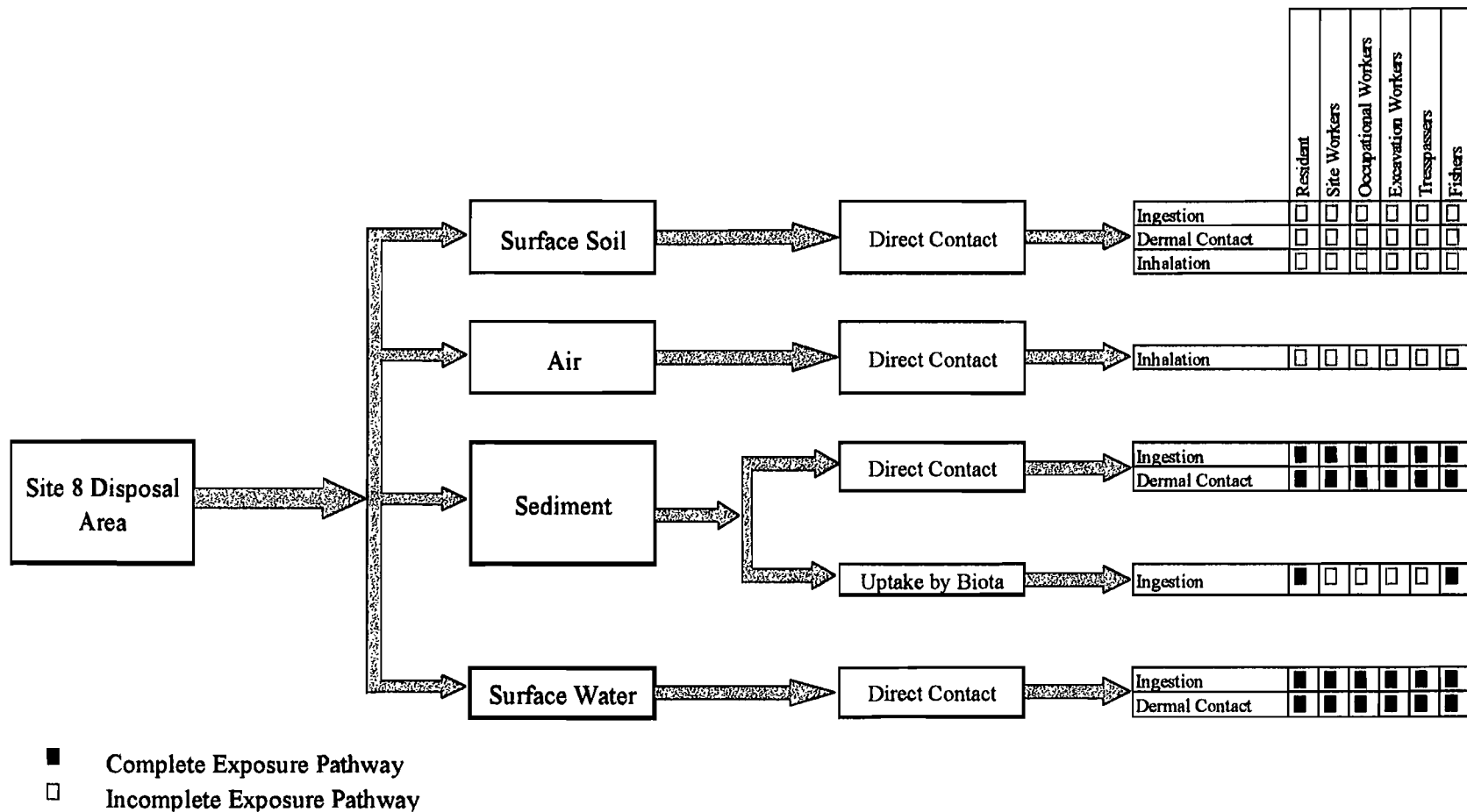


**FIGURE 3-1
RISK-BASED SITE CONCEPTUAL MODEL
(ON BASE)**

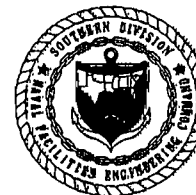


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**FIGURE 3-2
RISK-BASED SITE CONCEPTUAL MODEL
(OFF BASE)**



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home for 30 years (birth to age 30). On-base residents are assumed to live in the same home for three consecutive tours of duty or 10 years. The on-base remediation goals are based on children living in the same home from birth to age 10. Adolescents or adults may come into contact with surface soil or sediment while walking in the area (trespasser receptor). Additional receptors include site workers conducting maintenance activities, occupational workers performing ditch maintenance activities, and excavation workers digging into the soil or sediment. Occupational workers, while not likely under a residential use scenario, were evaluated for the purpose of completeness. All of these receptors can come into contact with the soil through incidental ingestion, dermal absorption, and inhalation of particulates.

- Exposure Scenario II: Partially Restricted Industrial Development. The area is developed as a light industrial complex such as office buildings. Parking lots are present. The remainder of the area is covered with grass and planted shrubbery. There are no residential structures and no schools or day care centers in the area. There are no opportunities for young children (less than 6 years old) to come into contact with soil or sediment. Adolescents or adults may come into contact with surface soil or sediment while walking in the area (trespasser receptor). Additional receptors include site workers conducting maintenance activities, occupational workers performing ditch maintenance activities, and excavation workers digging into the soil or sediment. All of these receptors can come into contact with the soil through incidental ingestion, dermal absorption, and inhalation of particulates.
- Exposure Scenario III: Restricted Industrial Development. The area is developed as a heavy industrial complex such as warehouses and truck depot facilities. There are no residential structures and no schools or day care centers exist in the area. There are no opportunities for young children (less than 6 years old) to come into contact with soil or sediment. In addition, the entire area has been completely covered with an impervious material such as concrete. There is no opportunity for trespassers, site workers, or occupational workers to come into contact with the soil or sediment. The only receptor is the excavation worker who cuts through the concrete and then digs into the soil or sediment. This receptor can come into contact with the soil through incidental ingestion, dermal absorption, and inhalation of particulates.

Appendix C presents the risk-based remediation level equation and input parameter values for soil and sediment. Parameter values are provided for each receptor. All remediation goals are expressed as TCDD TEQs. This approach is described below.

USEPA TCDD TEQ Approach. The analytical methodology for detecting 2,3,7,8-substituted dibenzo-p-dioxins and dibenzofurans in soil and sediment (USEPA Method 8290) actually detects a total of 75 tetra- through octa-chlorinated dioxin and furan congeners. However, only those 17 congeners with chlorine substitutions at molecular positions 2, 3, 7, and 8 are of toxicological importance. In addition, there are significant differences in the toxicity of the different 2,3,7,8-substituted dioxins and furans. Some are far more toxic than others. A simple presentation of the detected concentrations of all congeners is insufficient to adequately assess the potential toxicological effects associated with exposure to a complex mixture of these compounds (USEPA, 1989a).

To address this problem, the USEPA developed a method that reasonably estimates the toxicity of each congener by assigning a TEF. This value is based upon both toxicology data and structure-activity studies on the toxic mechanism of dioxin (USEPA, 1989). These studies showed 2,3,7,8-TCDD to be the most toxic of all the different congeners, and it was assigned a TEF of 1. All other 2,3,7,8-substituted congeners were less toxic and were assigned a TEF relative to TCDD. Those congeners without substitutions at molecular positions 2, 3, 7, and 8 were considered non-toxic, at least in terms of carcinogenic potency, and assigned a TEF of zero. The TEFs for the various dioxin and furan congeners are provided in Appendix C.

Applying the TEF to the analytical results of the various dioxin and furan congeners provides an expression of an equivalent amount of 2,3,7,8-TCDD. This is termed the TCDD TEQ. For example, the TCDD TEQ of a sample with 100 ppt of 2,3,7,8-pentachloro-p-dioxin is 50 ppt since the TEF for congener is 0.5 ($100 \times 0.5 = 50$). This process is repeated for all 2,3,7,8-substituted dioxin and furan congeners detected in a sample, and the sum of all these values is called the total TCDD TEQ. All risk-based remediation goals are total TCDD TEQs.

Table 3-1 provides the calculated surface soil and sediment remediation levels for each exposure scenario and each applicable receptor. It should be noted that the calculated residential surface soil remediation levels for on-base and off-base residents are 5.5 ppt and 3.9 ppt, respectively; however, a previous study (ABB-ES, 1996b) found difficulty in replicating TCDD TEQ results less than 15 to 20 ppt. The site-specific detection limit for dioxin at NCBC Gulfport is considered to be a minimum of 15 ppt, which is, therefore, considered the remediation goal for a residential receptor.

3.2 RECOMMENDED REMEDIATION GOALS. Where on-base residential receptors can reasonably be expected, dioxin concentrations are less than the site-specific detection level. Partially restricted industrial development is believed to be the most reasonable use scenario for determining remediation goals. Based on this scenario, the most stringent remediation goals are 50 ppt for surface soil and 102 ppt for sediment.¹

The most stringent remediation goals are based on the occupational receptor for Scenario II. As shown in Table 3-1, these goals are more stringent than the calculated surface soil and sediment remediation levels for all other receptors associated with the scenario; therefore, the Scenario II occupational receptor remediation levels will be protective of these other receptors.

For the remedial goal, it is recommended that soils be excavated to the soil remediation goal of 50 ppt and that sediments be excavated to the sediment remediation goal of 102 ppt. In areas where work or changes in the existing drainage system are likely, it is recommended that sediments be excavated to the soil remediation goal of 50 ppt.

¹ The cleanup goal calculation for surface soil used the highest risk value that can be rounded to 1×10^{-6} cancer risk expressed as one significant digit. Expressing cancer risk in one significant digit is mandated by USEPA guidance (USEPA, 1989b). The target risk value used in the equation (see Appendix C) is 1.49×10^{-6} . For the occupational worker, this target risk results in a dioxin cleanup value of 46 ppt, which was rounded to 50 ppt. The 50 ppt cleanup value was presented to MSDEQ for low-contact, occupational exposures at NCBC Gulfport.

**Table 3-1
Calculated Remediation Levels**

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Media	Exposure Scenario	Receptor	Remediation Levels ¹ (ng/kg or ppt)
Surface Soil	I	Resident (off base)	² 15
		Resident (on base)	² 15
		Occupational worker	50
		Trespasser	142
		Site worker	400
		Excavation worker	833
	II	Occupational worker	50
		Trespasser	142
		Site worker	400
		Excavation worker	833
	III	Excavation worker	833
Sediment	I	Resident (off base)	42
		Resident (on base)	61
		Trespasser	162
		Site worker	396
		Occupational worker	102
		Excavation worker	793
	II	Trespasser	162
		Site worker	396
		Occupational worker	102
		Excavation worker	833
	III	Excavation worker	833

¹ Remediation Levels are total TCDD TEQs.

² The actual calculated cleanup goals for off base and on base residents is 3.9 and 5.5 ppt, respectively. However, it has been demonstrated that the site-specific detection limit for 2,3,7,8-TCDD is at least 15 ppt. This level has been selected for the remediation goal for this exposure scenario.

Notes: ng/kg = nanograms per kilogram = ppt.
ppt = parts per trillion.
TCDD = tetrachlorodibenzodioxin.
TEQ = Toxic Equivalent.



4.0 VOLUME AND HEIGHT ESTIMATES

4.1 EXCAVATION VOLUME ESTIMATES. Volume estimates were developed for the 50-ppt and the 102-ppt remediation levels. Delineations of areas of excavation were determined based on dioxin results for samples collected on base and in the swamp. Figures 4-1 and 4-2 show plan views of the approximate areas of excavation required for the 50-ppt remediation level in on-base ditches and in the swamp, respectively. Figures 4-3 and 4-4 show plan views of the approximate areas of excavation required for the 102-ppt remediation level in on-base ditches and in the swamp, respectively. The excavated volumes are based on the estimated limits of excavation and estimated cross-sections and depths based on field observations and base maps. Assumptions are listed below.

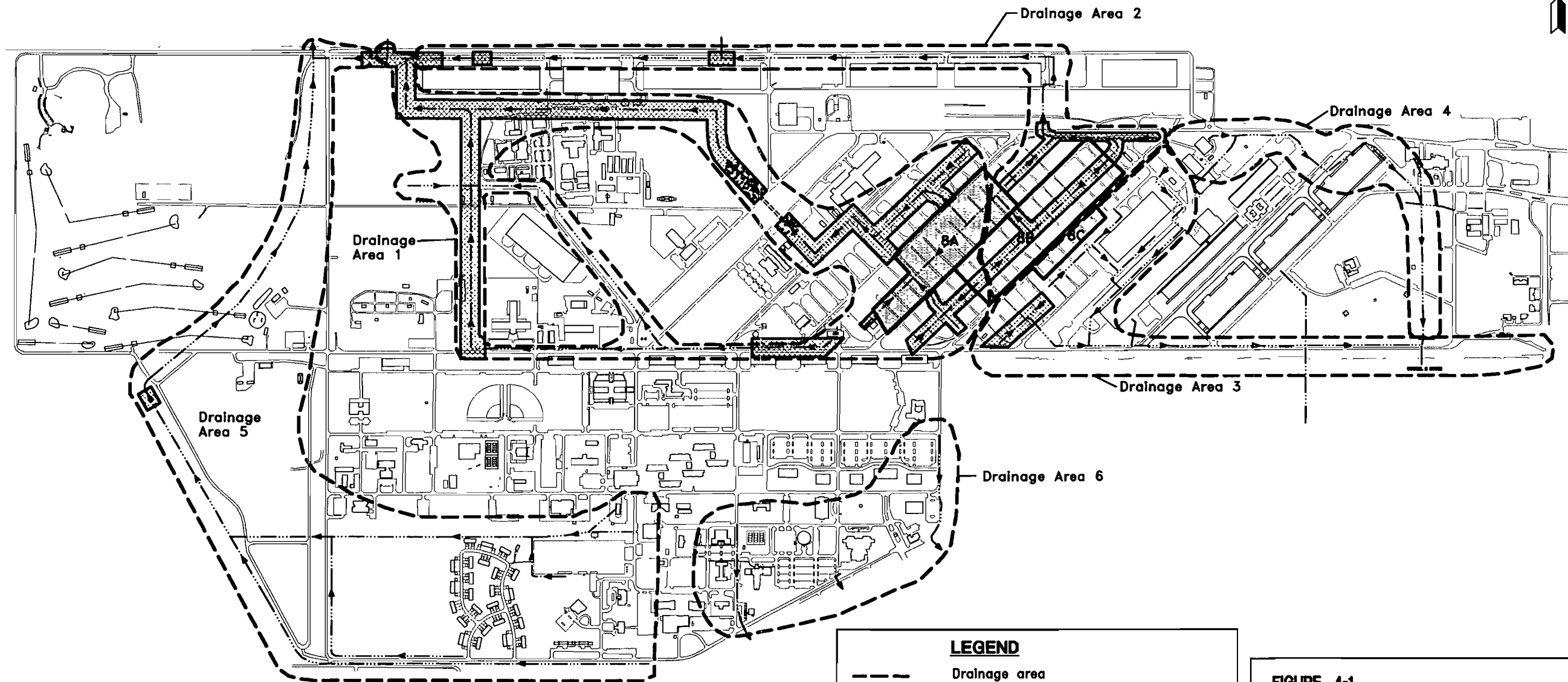
- The final covered area will be located on Site 8A. Contaminated materials already on Site 8A are not included in the excavated volume estimates. These contaminated materials include ash piles (approximately 20,730 cubic yards), sediments placed on site 8A from a 1995 removal action in areas adjacent to 28th Street (approximately 287 cubic yards), sediments excavated in the course of interim corrective measures at the NCBC (approximately 400 cubic yards), and construction rubble placed on Site 8A (approximately 500 to 700 cubic yards).
- Excavation from Site 8B drainage ditches is included; however, the FS should further investigate areas in Sites 8B and 8C where previous sampling found soil concentrations exceeding the risk-based remediation goal. Depending on results of the FS, additional excavation may be required from Sites 8B and 8C.
- No expansion after excavation was included because excavated material will be compacted on Site 8A.

For the on-base ditches, a preliminary cross-section of the drainage ditches perpendicular to the direction of flow was assumed based on field observations and base maps. This cross-section is shown in Figure 4-5. A more precise cross-section may be used based on potential upcoming pilot studies. The representative drainage ditch is trapezoidal in shape, with a 10-foot-wide bottom before sediment accumulation and 3:1 (horizontal to vertical) side slopes. The drainage ditch was assumed to be filled with a 2-foot depth of contaminated sediment. In the absence of further data related to depth of contamination, the 2-foot depth was assumed to be the same for both the 50-ppt and the 102-ppt volume estimates. The cross-sectional area of contamination was, therefore, assumed to be 32 square feet for both cases. The delineation length was defined as the length parallel to water flow of each ditch requiring excavation. The delineation lengths were different for each remediation level. The excavation volume was calculated for each remediation level by multiplying the delineation length of each ditch by the cross-sectional area of contamination and summing the products:

$$\text{Excavation Volume} = \Sigma[(\text{Delineation Length}) \times (\text{Cross - Sectional Area of Contamination})]$$

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NOTE:
See Figure 4-2 for
swamp area.



NOTE

1. Boundaries for Site 8B and Site 8C are approximate.
2. Width across drainage ditches is not to scale.

0 500 1000
SCALE: 1 INCH = 1000 FEET

LEGEND

- Drainage area
- ← Drainage ditch
- [Hatched pattern] Excavation of sediment or soil recommended
- [Cross-hatched pattern] Limited sampling results show Dioxin Toxicity Equivalents (TEQs) <50 ppt. Excavation recommended based on the fact that the segment is part of a major drainageway from Site 8A
- [Dotted pattern] Recommended covered area (Site 8A)

FIGURE 4-1
APPROXIMATE ON-BASE EXCAVATION AREAS
FOR DIOXIN REMEDIATION GOAL OF 50 ppt



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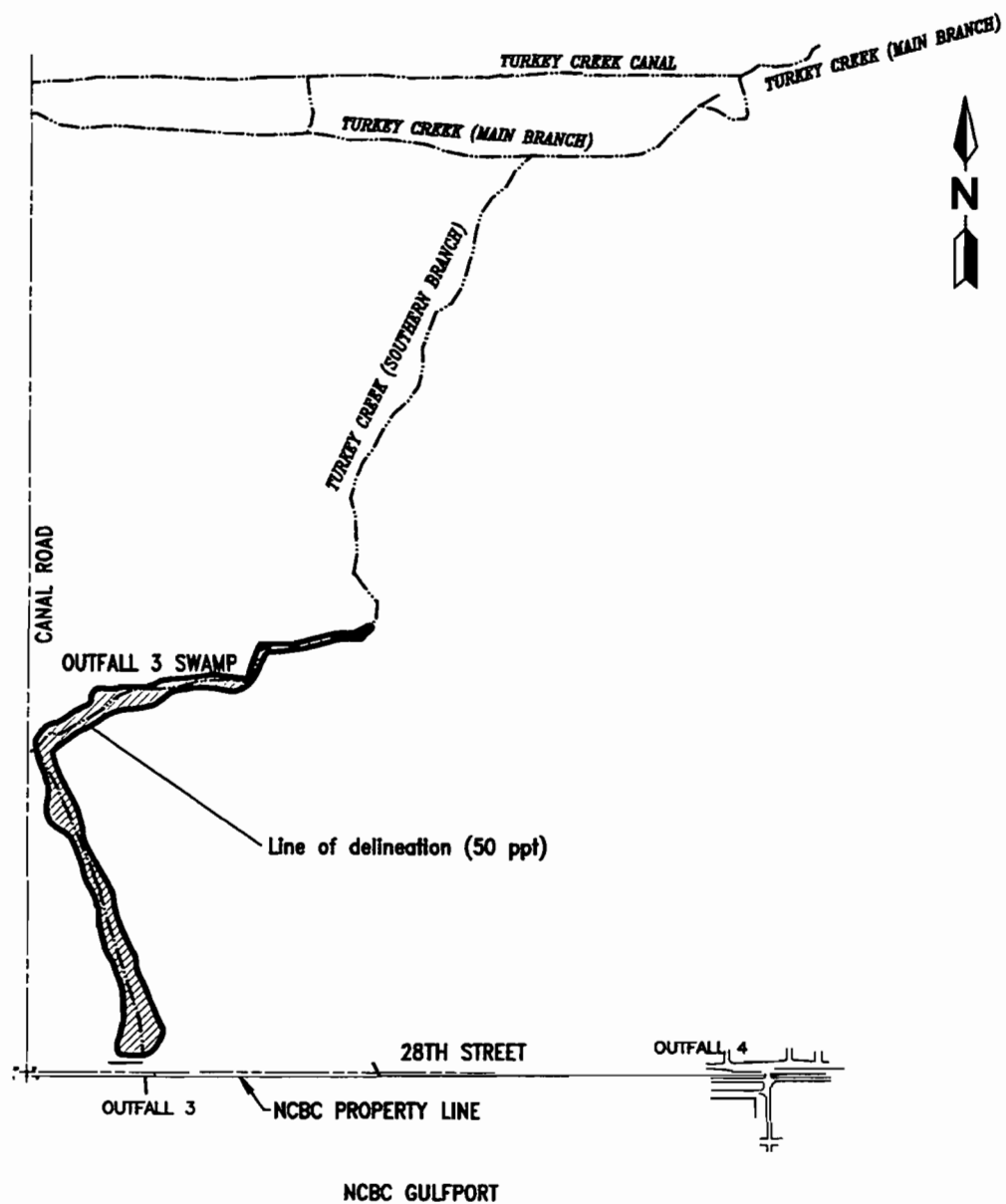


FIGURE 4-2
APPROXIMATE SWAMP EXCAVATION AREAS
FOR DIOXIN REMEDIATION GOAL OF 50 ppt

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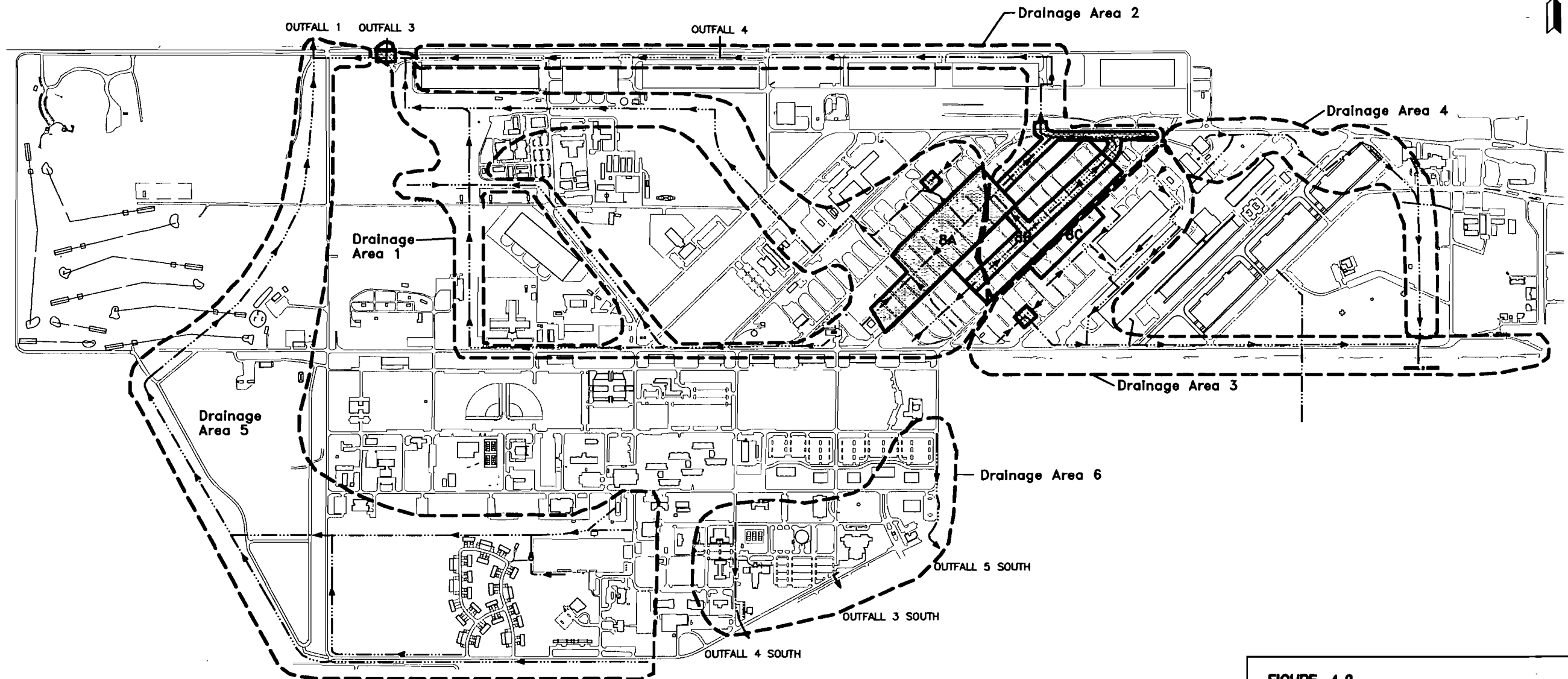


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NOTE:
See Figure 4-4 for
swamp area.



NOTE

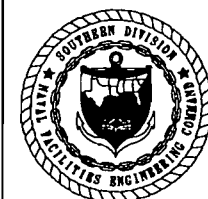
1. Boundaries for Site 8B and Site 8C are approximate.
2. Width across drainage ditches is not to scale.

LEGEND

- Drainage area
- Drainage ditch
- Excavation of sediment or soil recommended
- Recommended covered area (Site 8A)

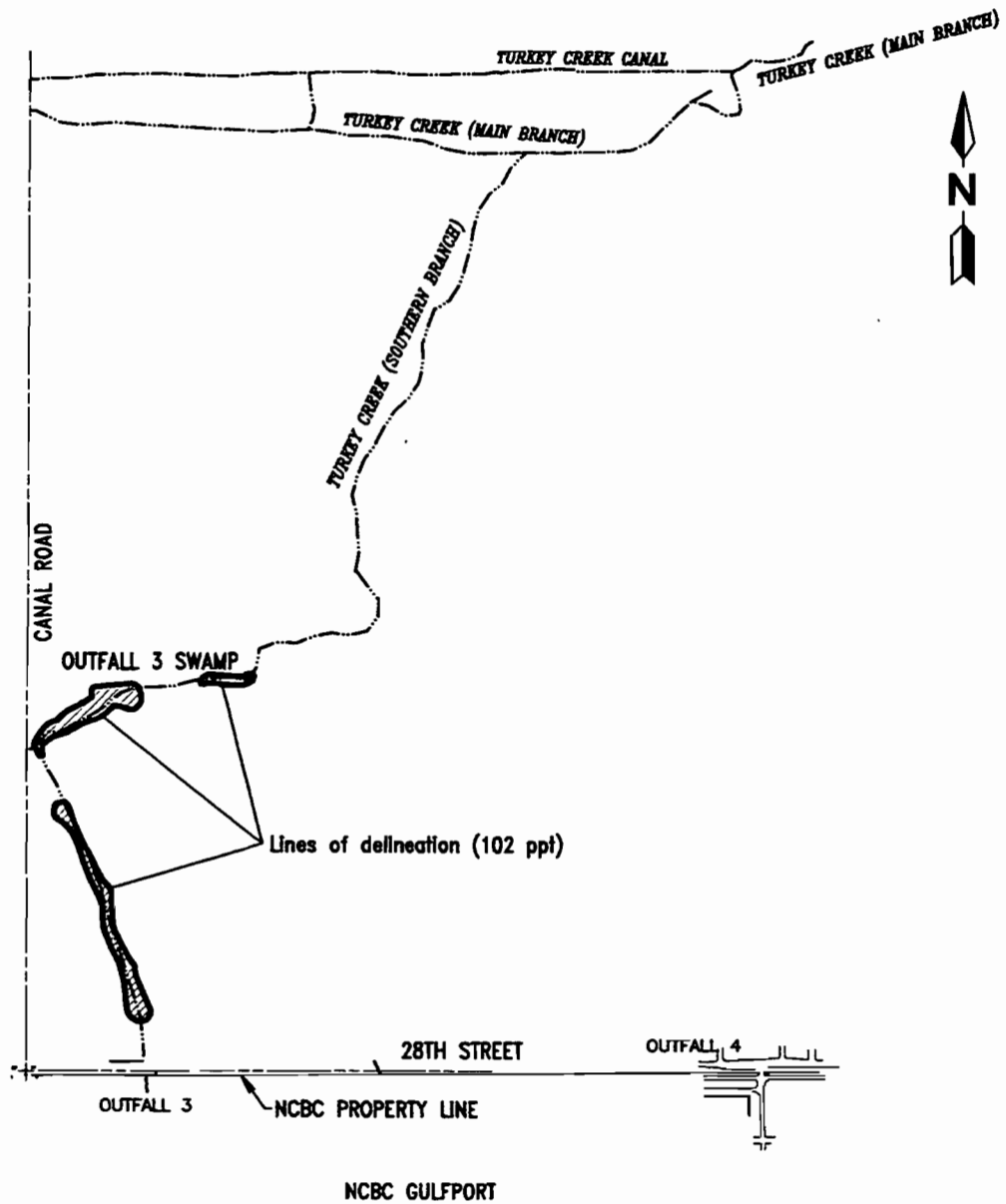
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SCALE: 1 INCH = 1000 FEET

FIGURE 4-3
APPROXIMATE ON-BASE EXCAVATION AREAS
FOR DIOXIN REMEDIATION GOAL OF 102 ppt



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SCALE: 1 INCH = 1000 FEET

FIGURE 4-4
APPROXIMATE SWAMP EXCAVATION AREAS
FOR DIOXIN REMEDIATION GOAL OF 102 ppt

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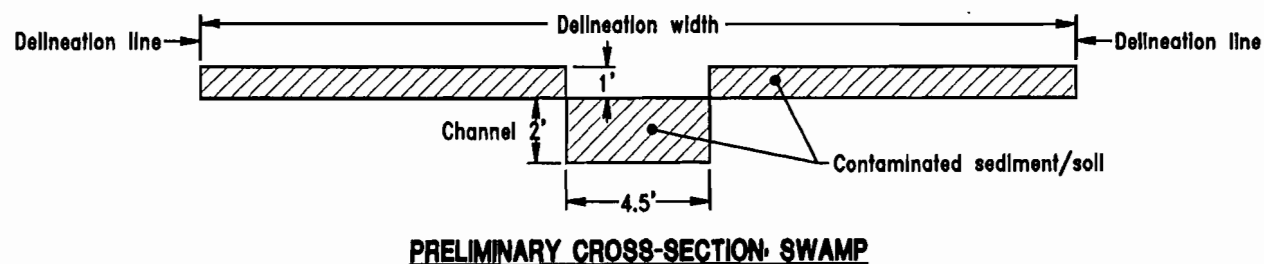
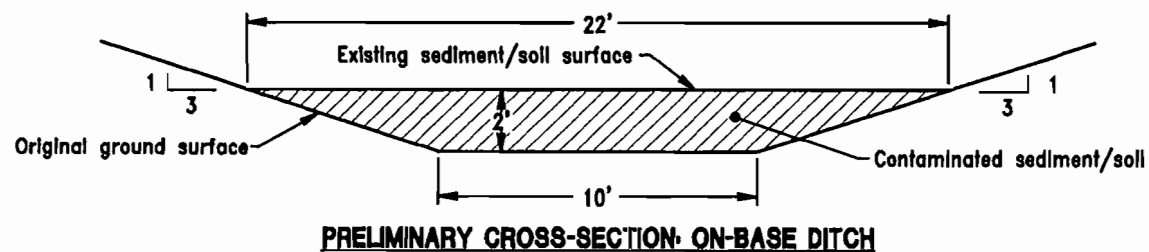


FIGURE 4-5
PRELIMINARY CROSS-SECTIONS FOR
ON-BASE DITCHES AND SWAMP
(VOLUME ESTIMATING PURPOSES)



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NOT TO SCALE

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For the swamp, AutoCAD™ Version 14 was used to calculate the area inside the delineation line (excavation area). A preliminary cross-section perpendicular to the direction of flow was assumed based on field observations. This cross-section is shown in Figure 4-5. A more precise cross-section may be used based on upcoming potential pilot studies. The cross-section consists of a 4.5-foot-wide rectangular channel with a 2-foot depth of contamination and an area with a 1-foot depth of contamination on each side of the channel. The 1-foot depth of contamination extends to the delineation line on each side of the channel. The delineation width is the distance between delineation lines perpendicular to the flow direction (See Figure 4-1). Based on the delineation width at various locations, an average depth of contamination of 1 foot was assumed throughout the swamp. The excavation volume was calculated by multiplying the area inside the delineation lines by the average depth of contamination of 1 foot:

$$\text{Excavation Volume} = ([\text{Delineation Surface Area}] \times [\text{Depth of Contamination}])$$

The resulting estimated excavation volumes are shown in Table 4-1.

Table 4-1
Estimated Excavation Volume

Remediation Planning Document Naval Construction Battalion Center Gulfport, Mississippi			
Remediation Goal [ppt]	Excavation Volume (yd ³)		
	On-Base Ditches*	Swamp	Total
50	18,200	12,600	30,800
102	4,740	5,700	10,440

* Includes Site 8B drainage ditches. The Feasibility Study should further investigate areas on Sites 8B and 8C where previous sampling found soil concentrations exceeding the risk-based remedial goal. Depending on the results of the Feasibility Study, additional excavation may be required from Sites 8B and 8C.

Notes: ppt = parts per trillion.
yd³ = cubic yards.

It should be noted that expansion following excavation is not included in the excavation volume estimates because sediments and soil will be compacted in the remedial action.

4.2 SITE 8A WASTE VOLUME ESTIMATES. The waste on Site 8A will not require excavation because Site 8A is the receiving area for the materials excavated from the on-base ditches, the swamp, Site 8B, and Site 8C. There are currently three types of waste material on Site 8A: ash piles resulting from the incineration of dioxin-contaminated soil during 1986 through 1988, sediment removed from areas adjacent to 28th Street prior to a 1995 road improvement, and construction rubble from NCBC projects. The ash pile volume was estimated to be 20,730 cubic yards (ABB-ES, 1995b). The volume of sediments placed on Site 8A as a result of the 28th Street removal was approximately 287 cubic yards (ABB-ES, 1995a). The volume of sediments placed

on Site 8A as a result of the interim corrective measures was approximately 400 cubic yards (Barrentine, 2000). The volume of construction rubble placed on Site 8A was estimated by the NCBC to be between 500 and 700 cubic yards (Crane, 1999).

4.3 HEIGHT ESTIMATES. Estimates were calculated of the height of the covered area above ground elevation for the 50-ppt and 102-ppt remediation goals. The ground elevation was considered to be the baseline ground elevation, that is the ground elevation without considering the waste currently on Site 8A. The waste material is considered the waste material currently located on Site 8A (ash piles, sediment from the 28th Street project, sediment from the interim corrective measures, and construction rubble) and soil/sediment excavated from the on-base ditches, and the swamp. Waste materials excavated from Site 8B ditches are included. The FS should further investigate areas on Sites 8B and 8C where previous sampling found soil concentrations exceeding the risk-based remedial goal. Depending on the results of the FS, additional excavation may be required from Sites 8B and 8C. It is assumed that the subgrade and cover will be 1.3 feet high. The estimates do not account for side slopes. The covered area was assumed to be 13 acres, based on the area of Site 8A scaled from the topographic map. The railroad tracks located on Site 8A were not included in the area. The estimated heights above ground elevation are listed in Table 4-2.

Table 4-2
Estimated Heights Above Ground Elevation¹

Remediation Planning Document Naval Construction Battalion Center Gulfport, Mississippi	
Remediation Goal (ppt)	Height Above Covered area ² (feet)
50	3.7
102	2.7

¹Includes material from Site 8B ditches. No soils from Sites 8B and 8C are considered.

²Heights are rounded to the nearest tenth of a foot.

Note: ppt = parts per trillion.



5.0 REMEDIAL DESIGN AND EXECUTION

The proposed remedial action consists of excavating dioxin-contaminated soil and sediment from on-base drainage ditches (including Site 8B drainage ditches), and the off-base swamp to the north of Outlet No. 3. Excavated material will be transported to Site 8A. The excavated material will be mixed with the material already on Site 8A and the mixture will be covered. The cover will prevent human and wildlife contact with dioxin-contaminated material at the remediation site and prevent migration of dioxin-contaminated material from the remediation site. The cover will allow the NCBC to use the completed covered area for the function determined by the Navy. The purpose of this chapter is to provide issues to be addressed in the design and execution of the remedial action.

For the remedial goal, it is recommended that soils be excavated to the soil remediation goal of 50 ppt and that sediments be excavated to the sediment remediation goal of 102 ppt. In areas where work or changes in the existing drainage system are likely, it is recommended that sediments be excavated to the soil remediation goal of 50 ppt.

5.1 ASSUMPTIONS. The following design basis assumptions have been made.

- The calculated site-specific remediation levels based on the most likely Scenario are 50 ppt for soil and 102 ppt for sediment. These remediation levels were presented in a meeting with the MSDEQ on February 2, 2000.
- Site 8A is the only land available for the covered area.
- The final use for the covered area is generally to be a lay-down (parking lot/storage) area. The load-bearing requirements are currently unknown.
- The uptake of dioxin from the sediment/soil into the aboveground part of vegetation is insignificant. The aboveground part of vegetation can be removed from the site, provided it has not been contaminated with sediment/soil.

5.2 DELINEATION SAMPLING. Additional delineation sampling is required to completely characterize contaminated areas. The design should specify pre-excavation soil and sediment sampling protocols to better establish the limits of expected excavation in the swamp.

5.3 SITE PREPARATION. The RAC should clear and grub the covered area. Vegetation on the covered area should be cut within 6 inches of the ground surface. Site 8B, Site 8C, on-base ditches, and swamp areas should be cleared of significant-sized trees and brush prior to excavating the underlying soil and sediment. The purpose is to avoid vegetation occupying a significant volume of the covered area, adversely impacting load-bearing capacity. Vegetation removal in the swamp will also be needed to allow sufficient workspace to excavate contaminated sediment and soil. In the case of water-filled drainage ditches or swamp channels, trees and brush of significant size should be cut from each excavation area after water has been routed around the

work area. Vegetation in excavation areas should be cut within 6 inches of the ground surface. The City of Gulfport requires a permit to cut certain kinds of trees (see Subsection 5.15.3). Care should be taken not to contaminate vegetation with contaminated soil or sediment. Vegetation can be taken off Site 8A and the excavation areas, based on the assumption that it is not contaminated.

Access agreements should be in place before any site preparation work is conducted in the swamp. As part of requesting access to land in the swamp, the appropriate landowners should be notified of any plans to construct temporary roadways and remove vegetation. A site restoration plan should be negotiated as part of the access agreement.

Prior to beginning any work in an excavation area, appropriate sediment control measures should be in place to minimize the possibility of the transport of contaminated sediments outside the excavation areas.

The design should specify all access routes for equipment to reach excavation areas and all haul routes for transporting contaminated material from excavation sites to the covered area. Haul routes from the swamp should include the route over public roads from the swamp borders to the base entrance. Temporary roads will be needed for swamp access and may be needed for access to some on-base areas. Temporary roadways should be constructed and maintained to provide access to work areas, as required for efficient execution of the work. More than one access point may be desirable for working in the swamp. Access roads should be constructed in accordance with all property access agreements. The RAC may need to remove vegetation in order to construct temporary roadways in the swamp.

The design of temporary roads should include the following.

- The location of temporary roads.
- Requirements for clearing of vegetation or other obstructions.
- Any necessary permits (see Subsection 5.15.3).
- Any necessary grading or filling.
- Construction materials. Shell and gravel are possibilities, but temporary wooden roads, geosynthetically reinforced roads, and other innovative roads should be evaluated as part of the design.

5.4 MATERIALS HANDLING. The design should fully address issues related to excavation, dewatering, sediment and erosion controls, surface water drainage during construction, and access to and transportation of contaminated materials.

Excavation techniques should be employed to minimize the transport of contaminated sediment and to minimize the quantity of water removed with excavated sediments. Typically excavation of individual ditches should proceed from upstream to downstream locations, that is, in the direction of water flow. Excavation areas should be minimized to minimize disturbance to aquatic biota. It is recommended that excavation areas be limited to work

that can be accomplished in a 2- to 3-day work period. Surface water should be diverted around all sediment removal areas. Water handling equipment should be adequately sized to manage the water expected during the work time in the ditch. Measures should be taken to prevent backflow and re-contamination, for example during storm events.

Water accumulated within the excavation area after excavation begins should be pumped out and stored temporarily until suspended sediments have settled. The design should specify an appropriate turbidity used to determine that adequate settling has occurred. The water should be tested following the settlement period. The design should specify an appropriate method for testing the water. If the dioxin concentration in the water is less than the maximum contaminant level (MCL) of 30 parts per quadrillion (ppq), the water may be released to the downstream side of the excavation. Water with dioxin concentrations exceeding the MCL cannot be released, but must undergo further treatment, for example, activated-carbon filtration. The settled sediment should be transported to the covered area and managed in the same manner as excavated sediments. Each excavation area should be restored as described in Section 5.11.

Excavated tree roots should be managed appropriately. Tree roots may be coated with dioxin-contaminated soil. The FS should investigate proper handling of tree roots. Depending on the final use of the completed covered area, it may be possible to grind up contaminated tree roots and place them in a limited area of Site 8A, where load-bearing requirements may be reduced.

Excavated sediments should be placed in the covered area and mixed with ash (see Section 5.7) in a manner resulting in the uniform mixture of sediment and ash. The required moisture content should be that needed to produce the physical properties required to support further site development.

The design should require excavation and materials handling methods to minimize airborne transport of contaminated materials to areas outside the excavation areas. The design should include an adequate air monitoring program. This air monitoring program should be approved by the appropriate regulatory agencies and implemented as part of site remedial activities.

During construction of the remedy, it is expected that sediments will be stockpiled in the excavation areas and on the covered area. The design should include detailed methods to prevent erosion of stockpiled materials due to stormwater runoff and wind. Stockpiled materials should be included in the air monitoring program specified in the design.

5.5 CONFIRMATION SAMPLING. Adequate confirmation sampling is critical to ensuring with an acceptable degree of certainty that all contaminated materials with concentrations exceeding the remediation goal have been excavated. The results of confirmation sampling should be obtained and found satisfactory for each excavation area prior to the acceptance of an area as completed. Further excavation and resampling should be required if confirmation sampling shows that remediation goals have not been achieved. The design should specify soil and sediment confirmation sampling locations and protocols.

For the on-base ditches, it is recommended that a composite sample be collected at each location. The composite sample should consist of material from the channel bottom and each side of the channel. For the swamp, it is recommended that a set of confirmation samples be collected at each location. It is recommended that each set of swamp samples include at least one sample taken from the channel midline and two samples taken at increasing distances transverse to the channel midline on each side (a total of five samples). Actual sample locations for all excavation areas should be determined in the field and may be subject to change based on topography.

Confirmation sampling for all excavated areas should be complete and the results satisfactory prior to completely covering the waste at the covered area.

5.6 TRANSPORTATION AND CONTAMINATION CONTROL. Activities should be planned to prevent the spread of contamination outside excavation areas and the covered area. Preventing the spread of contamination during transportation between excavation areas and the covered area is of particular concern.

Transportation trucks and equipment entering the swamp should stay on the access roads to prevent contamination of tires. The design should specify transportation methods and procedures to ensure that contaminated material is not spread beyond the excavation area or the covered area. All equipment, transportation vehicles and personnel should be decontaminated as necessary before exiting excavation areas or the covered area. Equipment and transportation vehicle decontamination should include exterior surfaces of vehicles, including tires. Procedures should ensure that transportation vehicles do not leak or release excavated materials (soil, sediment, dust, or water).

The swamp is located outside the base boundaries across 28th Street, which is a public road. Trucks will need to cross 28th Street in order to transport contaminated sediment from the swamp onto base property. Any required permits must be obtained for transporting dioxin-contaminated material/waste across a public road prior to initiating excavation operations (see Subsection 5.15.3).

Similarly, trucks transporting contaminated sediments from on-base locations to the receiving site will need to be decontaminated to prevent the spread of contamination between the excavated area and Site 8A.

5.7 MIXING. It is recommended that the RAC mix excavated materials with the ash materials currently located at Site 8A. Sediment that has previously been placed on the covered area (Site 8A) should also be mixed with the ash and other amendments as necessary. The mixture should be designed to provide suitable subgrade for the final surface treatment that meets the Navy requirements for final site use. If any part of Site 8A will not be included in the covered area, soil, sediment, and ash from this part should be excavated and included in the ash-sediment mixture. Pre-design testing should be performed to verify the suitability of the mixture for its intended purpose. Due to the organic content of the sediments, mixing the sediment with the ash will also provide an organic matrix for sorption of residual dioxin in the ash. If the volume of on-site ash is not sufficient to meet the

design mix for all the sediments, the contractor should provide non-contaminated materials.

Representative, composite samples of both ash and sediment should be obtained and mixed at a constant ratio, based on volume. Based on current volume estimates, the calculated value of this ratio is approximately 1.2 to 1 (sediment to ash) for the 50-ppt remediation level. This ratio will vary with final volume estimates and if the remedial action criteria change. Pre-design testing should involve, at a minimum, the mixing of excavated materials with ash from Site 8A at several ratios and testing the resulting mixtures for geotechnical properties associated with the planned use. More than one mixture may be necessary and should be based on material consistency. Moisture-density testing using the Standard Proctor Test method (ASTM D698) should be performed on these mixtures. Soil amendments such as Portland cement, cement kiln dust, fly ash (types f or c), site soil, lime, or other bulking agents may be required and should be evaluated to provide the required physical properties for suitable subgrade for the planned site use.

Construction phase tests are recommended to ensure that the mixture is adequate for the final use of the completed covered area. During construction, on-site batch testing should be conducted of sediment/ash or sediment/non-contaminated material mixtures to ensure adequate strength of materials placed on site. The design should specify the frequency and procedure for obtaining batch samples.

5.8 PLACEMENT AND CONSOLIDATION. Construction debris that is already on Site 8A should be crushed and spread. The construction rubble should be covered by at least 1 foot of the ash-sediment mixture. If any part of Site 8A will not be included in the covered area, soil, sediment, and ash from this part should be excavated and included in the ash-sediment mixture.

It is recommend that, after mixing, the ash-sediment mixture be spread on the covered area in uniform lifts and compacted. The mixture should be compacted to the density determined as part of the design, based on the results of pre-design and design testing.

During the remedial action, the RAC should perform quality control compaction and other necessary testing to verify material properties.

5.9 COMPLETING THE COVERED AREA FOR FUTURE LAND USE. For the purpose of this remediation planning document, it is assumed that the completed covered area will be used as a lay-down (parking lot/storage) area; however, the final design should be based on the actual future site use as determined by the Navy.

The design should specify the following.

- The thickness, materials, and construction of the subbase between the waste material and the surface material. It is recommended that this layer be at least 1-foot thick, but may be thicker depending on load-bearing requirements and risk aspects of the future use of the area. A marker or a combination marker/geogrid reinforcement layer may underlie this subbase, if required for the intended use of the site.

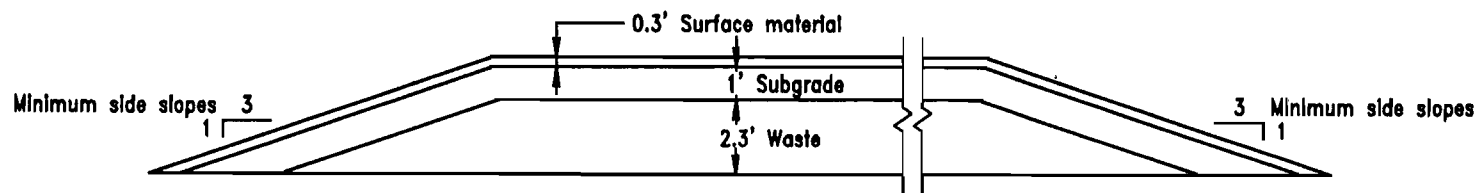
- The thickness, materials, and construction methods for the surface material. Options for the surface material include concrete and modified earth suitable for the intended use. Modified earth options include cementitious soil and lime, soil with Portland cement, and soil mixed with shells. In choosing a surface material, consideration should be given to land use requirements, availability of materials, construction cost, ease of construction, durability, maintenance requirements, and maintenance costs.
- The required side slopes, engineered for stability and erosion control and appropriate for the intended use.
- The design of means of ingress and egress, appropriate for the intended use and other applicable requirements.

Figure 5-1 provides a typical cross-section of the final covered area, based on the 50-ppt remediation level.

5.10 DRAINAGE IMPROVEMENTS. The design should include a drainage system to detain stormwater runoff from the completed covered area. The drainage system for the covered area should be such that, following implementation of the remedial action, the baseline drainage conditions should not be adversely impacted. Preliminary stormwater runoff calculations have been conducted using HydroCAD™, a software program that models the hydrology and hydraulics of surface runoff. HydroCAD™ uses unit hydrographs and stormwater routing procedures provided in the Soil Conservation Service (SCS) Technical Release (TR) 20 and TR 55 methods combined with standard hydraulic equations. The conceptual runoff calculations were performed, using a HydroCAD™ model of the base developed by HLA in 1997 with modifications made to the model to reflect the proposed remedial action of constructing a cover over Site 8A. The cover was assumed to be pavement. The 10-year, 24-hour storm event (approximately 8.8 inches of rain [SCS, 1975]) was used as the basis for stormwater modeling to compare existing and final peak runoff volumes from the site and size proposed drainage systems. The 10-year, 24-hour storm event is recommended based on the possible future use of the site as a lay-down (parking lot/storage) area; however, the actual design basis of the drainage improvements and the drainage model used should be determined as part of the final design.

Two important parameters in the model are Curve Number (CN) and time of concentration (T_c). The CN is based on the type of ground cover and is used to determine the potential maximum retention of water on the land surface. The CN for a drainage area is an area-weighted average of the CNs for different types of ground cover within the drainage area. A high CN means relatively low water retention on the drainage area, resulting in relatively higher runoff from the drainage area. For example, pavement with a CN of 98 would have higher runoff than open space in fair condition (hydrologic soil group A) with a CN of 49.

T_c is defined as the time for runoff to travel from the most hydrologically distant point of the watershed to the point of collection. HydroCAD™ calculates the T_c by summing the travel time for each consecutive flow segment within a drainage area. A lower T_c results in higher runoff from a drainage area.



NOTE

All thicknesses are approximate and based on the 50 ppt remediation level.

**FIGURE 5-1
TYPICAL CROSS-SECTION OF FINAL
COVERED AREA**



**REMEDATION PLANNING
DOCUMENT**

**NAVAL CONSTRUCTION
BATTALION CENTER
GULFPORT, MISSISSIPPI**

NOT TO SCALE

Currently, the drainage area (approximately 17.7 acres) that encompasses the major part of Site 8A consists primarily of ash piles and open areas with poor vegetation and, with the exception of relief at ash or debris piles, the area is very flat. For existing conditions, a composite runoff Curve Number of 65 was used and the T_c calculated to be approximately 59 minutes. The existing peak runoff rate was calculated to be approximately 37.3 cubic feet per second (cfs) with a total runoff volume of 6.1 acre-feet (AF) for a 10-year storm event. Under the assumed conditions, the majority of the drainage area would consist of a pavement cover of approximately 13 acres (based on the area of 8A scaled from the topographic map), resulting in a composite CN of 92. The substantial increase in CN is due to a CN of 98 used for the new pavement cover. The T_c is reduced to 32.6 minutes due to a significant amount of runoff that would occur on paved surfaces. Because of the increased CN and reduced T_c , the model estimates the peak runoff for proposed conditions will increase to 85.6 cfs with a total runoff volume is 10.3 AF for the 10-year storm event.

It is desirable to maintain the existing peak runoff rate after the remedial action is complete so that downgradient areas are not adversely impacted due to increased storm runoff. Stormwater detention will be required to maintain the existing peak runoff rate. The HydroCAD™ model estimates the required detention volume based on the difference between the timing and amount of runoff for the conditions before and after development. Based on the conceptual HydroCAD™ model estimates, approximately 5.4 AF of detention will be required. Constructing an 8- to 10-foot-wide ditch with a shallow (approximately 0.2 percent) slope around the perimeter (estimated to be 4,300 feet) would provide sufficient detention volume. Access to the covered area would require a culverted crossing of the perimeter ditch.

Other potential options for controlling increased runoff could include a detention pond outside of the Site 8A area, providing shallow storage areas on top of the paved cover on Site 8A, oversized catchbasins and drainage pipes, or a combination of these options. The selected stormwater detention method should require minimum maintenance.

5.11 SITE RESTORATION. The design should specify restoration methods for areas disturbed in the course of excavating on-base drainage ditches (including Site 8B drainage ditches) and swamp areas.

5.11.1 On-Base Drainage Ditches (Including Site 8B Drainage Ditches) Following surface water diversion necessary to excavate the on-base drainage ditches, the diversion system should be dismantled and flow restored in the drainage ditches. Any damaged ground surface should be repaired and any damaged vegetation should be replaced.

5.11.2 Swamp Areas The swamp areas should be restored in accordance with the site restoration plan (see Section 5.3). Unless the landowners agree to leave temporary roadways in place on their properties, the temporary roadways should be removed and the area restored to a condition acceptable to the landowner and the Navy. Clean fill should be placed in any excavated area, unless the landowner agrees to waive this option.

The possibility exists that the off-base swamp areas may become Brownfield sites. If this occurs, a separate set of requirements will apply to the swamp

areas and the design consultant should incorporate them into swamp restoration requirements.

5.12 MAINTENANCE REQUIREMENTS. The type and configuration of the cover utilized in the design will determine the requirements for long-term maintenance for the covered area. It is assumed that the FS will select the final cover, partially based on an evaluation of the costs associated with long-term maintenance. The design should include requirements for maintenance activities and a schedule for required activities.

The on-base ditches are part of the basewide drainage system. Following restoration (Subsection 5.11.1), maintenance should be in accordance with the base-wide drainage system requirements.

Sites 8B and 8C should be maintained as necessary to prevent erosion or as required by the future use of the sites.

After restoration of the swamp (see Subsection 5.11.3), maintenance of the swamp should be the responsibility of the landowners. There are no anticipated long-term maintenance requirements for the swamp at this time.

5.13 LONG-TERM MONITORING. The design should specify a long-term monitoring program to ensure that contamination is not being released from the covered area. The long-term monitoring program should include groundwater monitoring for dioxin outside the perimeter of the covered area.

5.14 WETLANDS RESTRICTIONS. At this time, there are no known wetlands restrictions applicable to implementing the remedial action.

5.15 OTHER CONSIDERATIONS.

5.15.1 Railroad Track Improvements The NCBC plans a major improvement to the railroad tracks immediately surrounding three sides of the covered area. The remedial action design should include provisions necessary to ensure that the tracks are not disturbed during the implementation of the remedial action. Temporary interruption of railroad operations should be kept to a minimum during the remedial action. The remedial action should be designed so that use of the completed covered area does not interfere with the proper functioning of the rail system.

5.15.2 Community Relations Maintaining good community relations is essential to the success of the remedial action. The base has maintained an honest, effective community relations program throughout the history of dioxin-related studies and activities both on and off base.

The public should be informed of the remedial action plans. They should be allowed a chance to comment on the remedial action and have their concerns and questions addressed. Excavation in the swamp and transport of contaminated materials from the swamp onto the base may be of particular concern to local residents. Community relations should include public notices, fact sheets, public comment periods, and public meetings.

5.15.3 Regulatory and Permitting Issues The design and remedial action implementation must comply with applicable regulatory and permitting requirements. This section points out some of the applicable regulatory issues, but is not meant to be a comprehensive discussion of legal requirements.

Applicable or relevant and appropriate requirements (ARARs) should be determined during the FS. The design should comply with ARARs.

The City of Gulfport has a tree protection ordinance (Ordinance No. 1841) that requires a permit to remove, relocate, substantially alter, or effectively remove as a result of damaging or destroying any protected tree. A protected tree is "any woody, perennial, hardwood plant that is either a live oak (*quercus virginiana*), southern magnolia, (*magnolia grandiflora*), sweetbay (*magnolia virginiana*), sweetgum (*liquidambar styraciflua*), or a red maple that has a single or multiple trunk with a total caliper trunk of 8 inches or a circumference of 25 inches or more. Also, any tree which has been registered with the Societe des Arbes. Caliper is defined as "the diameter of any tree trunk 36 inches above ground level." Appendix D provides a copy of the City of Gulfport tree protection ordinance. All remedial action work must comply with the requirements of the city ordinance. The City of Gulfport Urban Development Planning Division is the point of contact for tree removal issues.

The City of Gulfport also has a flood control ordinance (Appendix B of the City of Gulfport Code of Ordinances). Flood control requirements should be coordinated with the city Urban Development Planning Division and the city Engineering Department.

U.S. Department of Transportation (USDOT) Hazardous Material Regulations (HMR) apply to the transport of dioxin-contaminated soil or sediment from the swamp onto the base by public roads. These roads may include Canal Road or 28th Street. The regulations apply to contractor personnel who transport hazardous material across public roads; however, USDOT has issued a letter of interpretation that states that "shipments of hazardous materials transported by a government entity in vehicles operated by government personnel for noncommercial purposes are not subject to the HMR" (Fetner, 2000). If the remedial action is conducted in a manner that meets the requirements of the USDOT interpretation and USDOT concurs, the transportation would not be subject to USDOT regulations. It is recommended that this interpretation be further explored as part of the design. Appendix D provides the USDOT letter of interpretation.

RCRA requirements, such as manifesting, may apply to the transportation of waste from the swamp to the base. If the base and swamp qualify as a corrective action management unit (CAMU) and proper procedures are followed to establish this status, some of the typical RCRA requirements will not apply. It is recommended that CAMU status be pursued.

5.15.4 Land Use Controls for Future Use

5.15.4.1 On Base Land use controls (LUCs) should be in place for the on-base covered area to prevent future site use that could cause exposure to the contaminated material underneath the cover and subgrade. Housing developments and any other use that would allow uncontrolled contact with the underlying

material should be prohibited. LUCs should also be in place for the on-base ditches, Site 8B, and Site 8C to ensure that their future use is compatible with remaining dioxin concentrations. There should be procedures in place to ensure that LUCs are maintained in the future.

The USEPA Region 4 memorandum of April 13, 1998, provides policy on LUCs applicable to Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) actions at National Priorities List (NPL) sites. The policy is provided as guidance to Federal facilities taking CERCLA actions on non-NPL sites; therefore, the document provides guidance for LUCs for the proposed remedial action. Appendix D provides a copy of the USEPA memorandum. Actions specified in the memorandum include the following.

- Writing and implementing a detailed written LUC Assurance Plan (LUCAP) to assure the effectiveness and reliability of the required LUCs for as long as necessary for the remedial action to remain protective of human health and the environment. The LUCAP is an installation-wide plan for all areas at a particular installation that require LUCs. The LUCAP should be referenced in the base master plan.
- Developing a LUC Implementation Plan. This plan identifies each LUC objective for a particular area and specifies those actions required to achieve each identified objective (for example, a record notice in deed records). LUC Implementation plans specify what must be done to impose and maintain the required LUCs and are therefore analogous to design and/or operation and maintenance plans developed for active remedies.

The MSDEQ is currently working on LUC guidelines. When available, these guidelines should be implemented as appropriate to ensure that the necessary LUCs are put into practice.

5.15.4.2 Swamp Appropriate deed restrictions should be implemented for the swamp to ensure that future use is compatible with the dioxin concentrations in the swamp following completion of the remedial action.

6.0 RECOMMENDATIONS AND CONCLUSIONS

The proposed remedial action is complex, with many aspects that will require careful planning and coordination. There are likely to be elements of the design that will have to be altered based on actual field conditions at the time of the remedial action implementation.

In December 1999, HLA supervised the drilling of 22 soil borings on Site 8A, Site 8B, and the area to the northeast of Site 8A. SPT results were recorded. HLA also collected samples from 8 on-base ditches and 12 locations in the swamp. CBR Testing was conducted on soil from one boring. Mechanical grain-size analyses and Atterberg limit testing were conducted on seven samples from Sites 8A and 8B soil borings, two composite samples from the Site 8A ash piles, all samples from the on-base ditch samples, and all samples from the swamp. Results of the analyses indicate that the proposed remedial action is feasible.

For the remedial goal, it is recommended that soils be excavated to the soil remediation goal of 50 ppt and that sediments be excavated to the sediment remediation goal of 102 ppt. In areas where work or changes in the existing drainage system are likely, it is recommended that sediments be excavated to the soil remediation goal of 50 ppt.

Further delineation activities are recommended, especially in the swamp where complete delineation to the remediation goals has not been accomplished. Adequate confirmation sampling is needed to verify with acceptable certainty that all contaminated soil and sediment has been excavated.

Obtaining proper permits and access agreements is essential to performing the remedial action. In addition, maintaining good community relations is vital to the public acceptance of the remedial action. The base has maintained an honest, effective community relations program throughout the history of dioxin-related studies and activities both on and off base. This program should be continued. There should be a community relations plan that includes schedules for public notices, public comment periods, and public meetings.

Preventing the spread of contamination into clean areas will be critical. The transport of dioxin-contaminated soil and sediment from the swamp across 28th Street must comply with applicable USDOT regulations. It is possible that the remedial action may be conducted in such a manner that it would be exempt from USDOT regulations. This exemption is for shipments of hazardous materials transported by a government entity in vehicles operated by government personnel for noncommercial purposes. It is recommended that this exemption be further explored with the USDOT.

Excavated areas should be restored. For the on-base drainage ditches, including those on Site 8B, surface water diversion systems should be dismantled and flow restored in the ditches. Any damaged ground surface should be repaired and any damaged vegetation should be replaced. A site restoration plan should be developed as part of the access agreement for the swamp areas. Restoration of swamp areas should comply with the site restoration plan. Recommended restoration activities in the swamp include removing temporary roadways and placing clean fill in any excavated area.

The change in surface material resulting from the completed cover for Site 8A will significantly increase the surface water runoff from the site. A stormwater detention system is recommended so that, following implementation of the remedial action, the NCBC baseline drainage conditions will not be adversely impacted. The stormwater detention system should be designed to require minimal maintenance.

A long-term monitoring program is recommended to ensure that contamination is not being released from the covered area. The long-term monitoring program should include groundwater monitoring for dioxin outside the perimeter of the covered area. Groundwater may need to be further assessed off base during the FS.

LUCs are recommended to ensure future use of the base will not endanger human health. LUCs are necessary for the on-base covered area (Site 8A) and for the on-base ditches. Restrictions should prohibit uses, such as housing developments, that would allow uncontrolled contact with the waste material underneath the cover and subgrade or in the ditches. Deed restrictions are recommended for the swamp to ensure future use is compatible with dioxin concentrations remaining in soil in the swamp following completion of the remedial action.

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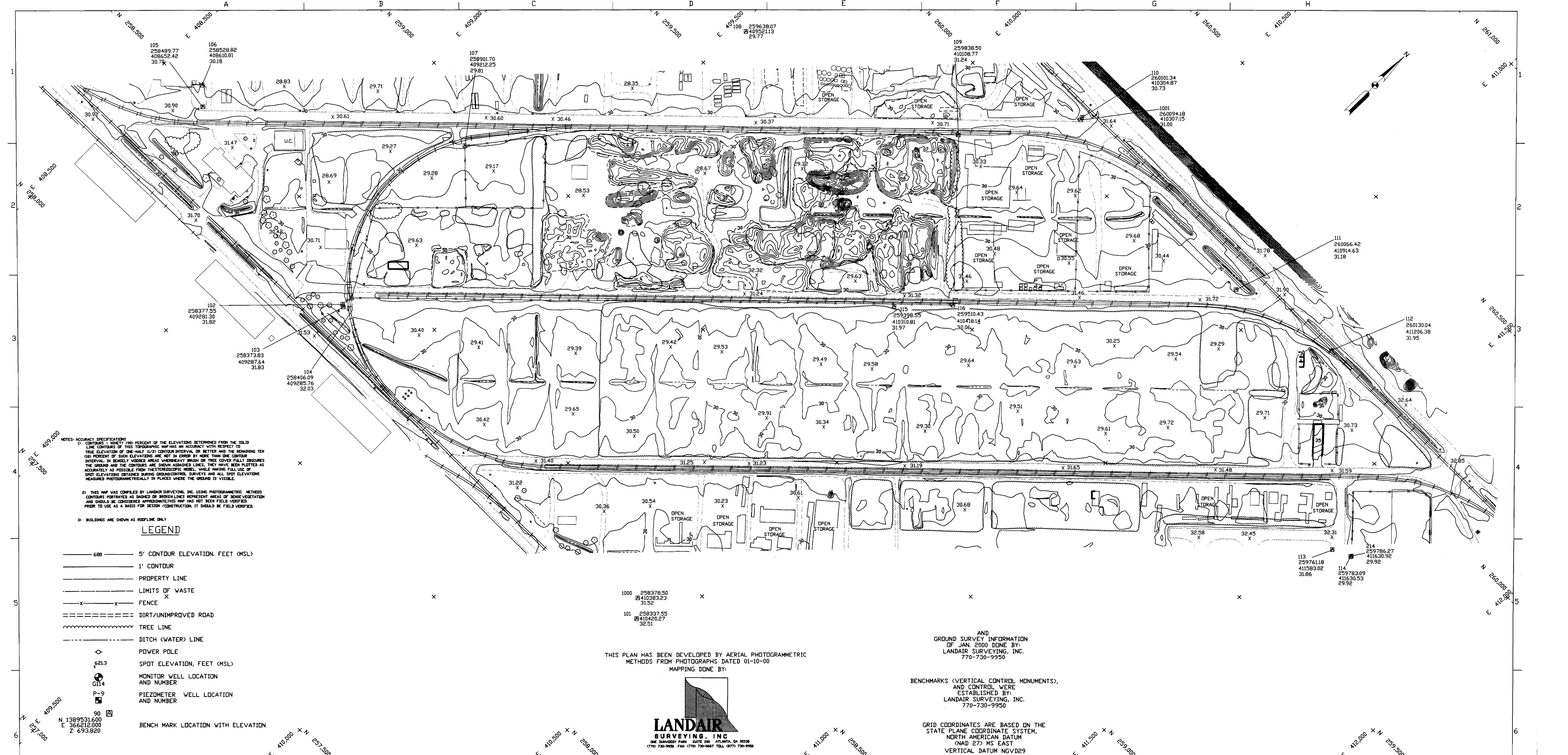
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APPENDIX A
TOPOGRAPHIC SURVEY MAP
(1-FT CONTOUR INTERVALS)



NOTES: ACCURACY SPECIFICATIONS:
1) CONTOURS - NINETY (90) PERCENT OF THE ELEVATIONS DETERMINED FROM THE SOLID LINE CONTOURS OF THIS TOPOGRAPHIC MAP HAS AN ACCURACY WITH RESPECT TO TRUE ELEVATION OF ONE-HALF (1/2) CONTOUR INTERVAL OR BETTER AND THE REMAINING TEN PERCENT OF SUCH ELEVATIONS ARE NOT IN ERROR BY MORE THAN ONE CONTOUR INTERVAL. IN DENSELY WOODED AREAS WHERE HEAVY BRUSH OR TREE COVER FULLY OBSCURES THE GROUND AND THE CONTOURS ARE SHOWN AS DASHED LINES, THEY HAVE BEEN PLOTTED AS ACCURATELY AS POSSIBLE FROM THEORETICAL MODEL, WHILE MAKING FULL USE OF SPOT ELEVATIONS OBTAINED DURING GROUND CONTROL SURVEYS AND ALL SPOT ELEVATIONS MEASURED PHOTOGRAMMETRICALLY IN PLACES WHERE THE GROUND IS VISIBLE.
2) THIS MAP WAS COMPILED BY LANDAIR SURVEYING, INC. USING PHOTOGRAMMETRIC METHODS. CONTOURS PORTRAYED AS DASHED OR BROWN LINES REPRESENT AREAS OF DENSE VEGETATION AND SHOULD BE CONSIDERED APPROXIMATE. THIS MAP HAS NOT BEEN FIELD VERIFIED. PRIOR TO USE AS A BASIS FOR DESIGN / CONSTRUCTION, IT SHOULD BE FIELD VERIFIED.
3) BUILDINGS ARE SHOWN AS ROOFLINE ONLY.

LEGEND

- 680 5' CONTOUR ELEVATION, FEET (MSL)
- 1' CONTOUR
- PROPERTY LINE
- LIMITS OF WASTE
- FENCE
- DIRT/UNIMPROVED ROAD
- TREE LINE
- DITCH (WATER) LINE
- POWER POLE
- SPOT ELEVATION, FEET (MSL)
- MONITOR WELL LOCATION AND NUMBER
- PIEZOMETER WELL LOCATION AND NUMBER
- BENCH MARK LOCATION WITH ELEVATION

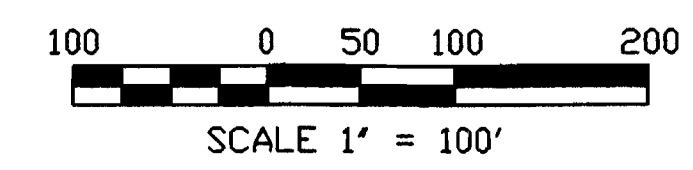
THIS PLAN HAS BEEN DEVELOPED BY AERIAL PHOTOGRAMMETRIC METHODS FROM PHOTOGRAPHS DATED 01-10-00
MAPPING DONE BY:



AND
GROUND SURVEY INFORMATION
OF JAN. 2000 DONE BY:
LANDAIR SURVEYING, INC.
770-730-9950

BENCHMARKS (VERTICAL CONTROL MONUMENTS),
AND CONTROL WERE
ESTABLISHED BY:
LANDAIR SURVEYING, INC.
770-730-9950

GRID COORDINATES ARE BASED ON THE
STATE PLANE COORDINATE SYSTEM,
NORTH AMERICAN DATUM
(NAD 27) MS EAST
VERTICAL DATUM NGVD29



HARDING LAWSON ASSOCIATES, INC
2590 Executive Center Circle E
Tallahassee, FL 32301

Revisions					
No.	Description	Date	By	No.	Description

Approved By: L. SWEETMAN
Checked By: J. CHAPMAN
Drawn By: D. EDWARDS

Project Location:
SITE TOPOGRAPHIC MAP
GULFPORT, MS

NAVAL CONSTRUCTION BATTALION CENTER

Drawing No. T-01-49184-113
Scale: As Shown
Date: JAN. 2000
Sheet Number: 1

APPENDIX B
GEOLOGICAL AND PHYSICAL DATA

Project: NCBC Gulfport Site 8ASite ID: GB-1Project No: 44236 0254062Comp. Date: 12/9/99Logged By: Deven CariganContractor: Pensacola TestingDriller: Matt HowardDrill Method: 6" OD HSARig Type: Diedrich 25Total Depth: 15 ft. bgsDepth To Water: 3.1 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	QVM Reading (ppm)	Material Description	USCS (observed)
1	1	83	3, 4, 5		Loose fine SAND, mottled light gray and orange, some silt, low moisture	SM
2						
4						
6	2	100	10, 11, 13		Medium dense, fine SAND, grading from light yellow-brown to light gray to yellow-tan, little to some silt, moist	SP/SM
8						
10	3	80	3, 4, 4		Top 0.5' Loose fine SAND, yellow-tan, little to some silt Bottom 0.7' Loose fine SAND, dark brown, trace fine angular gravel, trace medium sand, wet	SP/SM SP
12						
14	4	100	7, 7, 14		Medium dense fine SAND, grades from light tan to light orange to light brown, few fine angular gravel, moist	SP
16					Bottom of boring	
18						
20						

Harding Lawson Associates



Project: NCBC Gulfport Site 8A

Site ID: GB-2

Project No: 44236 0254062

Comp. Date: 12/9/99

Logged By: Deven Carigan

Contractor: Pensacola Testing

Driller: Matt Howard

Drill Method: 6" OD HSA

Rig Type: Diedrich 25

Total Depth: 16 ft. bgs

Depth To Water: 2.55 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	QVM Reading (ppm)	Material Description	USCS (observed)
1	1	60	3, 3, 4		<u>Top 0.3'</u> Loose fine SAND, mottled medium gray, yellow-orange and black, trace silt, slightly moist <u>Bottom 0.9'</u> Medium dense fine SAND, medium gray, trace silt, moist	SP
2	2	60	8, 9, 9, 10		Medium dense fine SAND, light gray, moist	SP
4	3	86	5, 6, 6, 10		<u>Top 0.4'</u> Same as above <u>Next 0.5'</u> Medium brown <u>Next 0.4'</u> Dark brown, odor	SP
6	4	100	5, 6, 6, 7		Medium dense fine SAND, medium/dark brown, trace silt, few fine gravel, moist	SP
8	5	100	2, 4, 6, 5		Same as above with trace fine sub-angular to sub-rounded gravel, wet	SP
10	6	100	2, 2, 7, 7		Loose fine SAND, medium/dark brown, trace to no silt, few fine gravel, wet, slight odor	SP
12	7	100	4, 4, 7, 9		Medium dense fine SAND, dark brown grading to medium brown, sand grains getting finer with depth, wet, slight odor	SP
14	8	100	2, 4, 8, 9		Continuation of above: grades to medium/light brown, very fine SAND	SP
16					Bottom of boring	
18						
20						

Harding Lawson Associates



Project: NCBC Gulfport Site 8A

Site ID: GB-4

Project No: 44236 0254062

Comp. Date: 12/9/99

Logged By: Deven Carigan

Contractor: Pensacola Testing

Driller: Matt Howard

Drill Method: 6" OD HSA

Rig Type: Diedrich 25

Total Depth: 15 ft. bgs

Depth To Water: 3.8 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVN Reading (ppm)	Material Description	USCS (observed)
1	1	93	8, 9, 8		Medium dense fine SAND, mottled light gray, tan and orange, some silt, slightly moist	SM
2						
4						
6	2	80	6, 6, 7		Medium dense fine SAND, grading from light brown to dark brown. Dark brown sand is silty and has an odor	SW SM
8						
10	3	100	5, 9, 9		Medium dense fine SAND, dark brown, few fine sub-rounded gravel, trace to no silt, odor	SP
12						
14	4	NR	8, 6, 9		Medium dense very fine SAND, dark brown, moist to wet, odor	SP
16					Bottom of boring	
18						
20						

NR = Not reported

Harding Lawson Associates



Project: NCBC Gulfport Site 8Annex

Site ID: GB-5

Project No: 44236 0254062

Comp. Date: 12/8/99

Logged By: Deven Carigan

Contractor: Pensacola Testing

Driller: Matt Howard

Drill Method: 6" OD HSA

Rig Type: Diedrich 25

Total Depth: 16 ft. bgs

Depth To Water: 3.5 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
1	1	100	9, 5, 4		Loose fine SAND, mottled medium yellow-brown and light brown, little silt, slightly moist	SP
2	2	75	7, 8, 13, 15		Top 0.4' Medium dense fine SAND, tan, moist Next 0.9' Fine SAND, pinkish-gray, some silt, moist	SP
4	3	77	9, 13, 16, 23		Continuation of above	SP
6	4	100	9, 12, 13, 10		6.0 - 6.3' Continuation of above with fine gravel 6.3 - 8.0' Medium dense fine SAND, medium/dark brown, some silt, moist, odor	SP SM
8	5	100	5, 6, 8, 10		Medium dense fine SILTY SAND, medium/dark brown, trace fine gravel, wet, odor	SM
10	6	100	1, 2, 5, 7		Same as above	SM
12	7	100	11, 15, 15, 17		Medium dense fine SILTY SAND, medium/dark brown, trace to no silt, wet, odor. Trace fine sub-rounded gravel in bottom 0.5'	SP
14	8	100	7, 8, 11, 14		Medium dense fine SILTY SAND, medium/dark brown, trace to no silt, trace fine sub-rounded gravel, wet, odor	SP
16					Bottom of boring	
18						
20						

Harding Lawson Associates



Project: NCBC Gulfport Site 8Annex

Site ID: GB-6

Project No: 44236 0254062

Comp. Date: 12/8/99

Logged By: Deven Carigan

Contractor: Pensacola Testing

Driller: Matt Howard

Drill Method: 6" OD HSA

Rig Type: Diedrich 25

Total Depth: 15 ft. bgs

Depth To Water: 4.7 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
1	1	87	13, 3, 2		Top 0.5' Loose fine SAND, brown-orange, some silt, trace fine rounded to sub-angular gravel, dry Next 0.9' Seashell material, white, purple and blue, dry Next 0.4' Soft silt mixed with shell material, black, sticky, moist	SM ML
2						
4						
6	2	93	1, 2, 3		Soft SILT, medium gray, some fine sand, sticky, moist	ML
8						
10	3	100	8, 11, 14, 18		Medium dense fine to medium SAND, light gray/tan, fine rounded gravel, very moist	SW
12						
14	4	NR	6, 6, 12		Medium dense, fine SAND, medium gray, moist	SP
16					Bottom of boring	
18						
20						

NR = Not reported

Harding Lawson Associates



Project: NCBC Gulfport Site 8Annex

Site ID: GB-7

Project No: 44236 0254062

Comp. Date: 12/8/99

Logged By: Deven Carigan

Contractor: Pensacola Testing

Driller: Matt Howard

Drill Method: 6" OD HSA

Rig Type: Diedrich 25

Total Depth: 15 ft. bgs

Depth To Water: 4.5 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	QVM Reading (ppm)	Material Description	USCS (observed)
1	1	87	24, 13, 11		Medium dense, fine SAND, mottled brown-orange, black and medium brown, little silt, slightly moist	SP
2						
4						
6	2	80	6, 4, 5		Loose, fine SAND, light/medium gray, trace to little silt, moist, odor	SP
8						
10	3	100	7, 8, 10		Medium dense, fine SAND, dark brown, trace silt, few fine rounded gravel, moist to wet, odor	SP
12						
14	4	100	7, 9, 16		Medium dense, fine SAND, trace medium sand, trace fine gravel, moist to wet, odor	SP
16					Bottom of boring	
18						
20						

Harding Lawson Associates



Project: NCBC Gulfport Site 8A

Site ID: GB-8

Project No: 44236 0254062

Comp. Date: 12/9/99

Logged By: Deven Carigan

Contractor: Pensacola Testing

Driller: Matt Howard

Drill Method: 6" OD HSA

Rig Type: Diedrich 25

Total Depth: 16 ft. bgs

Depth To Water: 3.4 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
1	1	60	6, 5, 5, 4		<u>Top 0.9'</u> Loose fine SAND, mottled light gray and yellow brown, some silt, slightly moist <u>Bottom 0.3'</u> Loose fine SAND, light gray, trace silt, slightly moist	SM
2	2	80	3, 4, 5, 8		<u>Top 0.9'</u> Medium dense fine SILTY SAND, mottled brown-orange and light gray, slightly moist <u>Bottom 0.7'</u> Fine SAND, light gray, slightly moist	SM SP
4	3	68	4, 5, 9, 10		Medium dense fine SAND, light gray, slightly moist	SP
6	4	70	6, 8, 10, 11		Medium dense fine SAND, dark brown and medium/dark brown, trace silt, trace fine rounded gravel, moist	SP
8	5	95	4, 7, 8, 14		<u>Top 0.3'</u> Medium dense fine SAND, medium brown <u>Bottom 1.6'</u> Medium dense fine SAND, dark brown, some silt, some fine sub-rounded to rounded gravel, moist	SP SM
10	6	100	3, 9, 11, 14		Medium dense fine SAND, dark brown, trace silt, some fine rounded gravel, moist. No gravel in bottom 0.4'	SP
12	7	100	7, 14, 18, 22		Medium dense fine SAND, dark brown, few fine gravel, trace coarse sand, moist	SP
14	8	NR	7, 10, 14, 19		Dense fine SAND, dark brown, moist	SP
16					Bottom of boring	
18						
20						

NR = Not reported

Harding Lawson Associates

Project: NCBC Gulfport Site 8ASite ID: GB-9Project No: 44236 0254062Comp. Date: 12/9/99Logged By: Deven CariganContractor: Pensacola TestingDriller: Matt HowardDrill Method: 6" OD HSARig Type: Diedrich 25Total Depth: 15 ft. bgsDepth To Water: 2.65 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
1	1	100	5, 4, 4		Loose fine SAND, yellow and tan, trace silt, moist	SP
2						
4						
6	2	NR	4, 5, 6		Medium dense fine SAND, light brown and black, moist	SP
8						
10	3	NR	8, 7, 13		Medium dense fine SAND, dark brown, trace fine rounded gravel, trace to no silt, moist to wet, odor. Contains 0.1' band of orange plastic silt at top of sample	SP
12						
14	4	NR	2, 5, 7		Medium dense fine SAND, dark brown, moist, odor	SP
16					Bottom of boring	
18						
20						

NR = not reported

Harding Lawson Associates



Project: NCBC Gulfport Site 8A

Site ID: GB-10

Project No: 44236 0254062

Comp. Date: 12/10/99

Logged By: Deven Carigan

Contractor: Pensacola Testing

Driller: Matt Howard

Drill Method: 6" OD HSA

Rig Type: Diedrich 25

Total Depth: 15 ft. bgs

Depth To Water: 2.8 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
1	1	100	3, 3, 4		Loose, fine SAND, trace to some silt, slightly moist, medium brown from 0.0 - 0.7', yellow-tan from 0.7 - 1.5'	SP
2						
4						
6	2	80	9, 11, 10		Medium dense, fine SAND, medium gray, trace to no silt, moist	SP
8						
10	3	100	7, 9, 12		Medium dense, fine SAND, dark brown, few fine angular gravel, moist to wet, odor	SP
12						
14	4	100	6, 14, 16		Medium dense, fine SAND, grading from medium to light brown, moist to wet, odor in brown sand	SP
16					Bottom of boring	
18						
20						

Harding Lawson Associates



Project: NCBC Gulfport Site 8A

Site ID: GB-11

Project No: 44236 0254062

Comp. Date: 12/10/99

Logged By: Deven Carigan

Contractor: Pensacola Testing

Driller: Matt Howard

Drill Method: 6" OD HSA

Rig Type: Diedrich 25

Total Depth: 15 ft. bgs

Depth To Water: 3.8 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
1	1	93	9, 6, 8		Medium dense fine SAND, trace to no silt, slightly moist, top 0.6' light brown, bottom 0.8' tan	SP
2						
4						
6	2	73	5, 4, 3		Loose fine SAND, light brown, trace patches of dark gray silty material, moist	SP
8						
10	3	100	9, 7, 10		Medium dense fine SAND, trace to no silt, moist to wet, odor, 9.0 - 9.3' light brown, 9.3 - 10.5' dark brown	SP
12						
14	4	100	8, 13, 15		Medium dense fine SAND, dark brown, trace to no silt, moist	SP
16					Bottom of boring	
18						
20						

Harding Lawson Associates

HLA

Project: NCBC Gulfport Site 8A

Site ID: GB-12

Project No: 44236 0254062

Comp. Date: 12/9/99

Logged By: Deven Carigan

Contractor: Pensacola Testing

Driller: Matt Howard

Drill Method: 6" OD HSA

Rig Type: Diedrich 25

Total Depth: 15 ft. bgs

Depth To Water: 3.7 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
1	1	100	2, 2, 2		Top 0.8' Loose fine SILTY SAND, medium brown, slightly moist Bottom 0.7' Loose fine SAND, medium brown, moist	SM SP
2						
4						
6	2	NR	7, 7, 9		Medium dense fine SAND, grading from yellow-tan to tan to light brown, moist	SP
8						
10	3	80	7, 7, 8		Medium dense fine SAND, dark brown, trace silt, few fine angular gravel, wet	SP
12						
14	4	NR	7, 9, 12		Medium dense fine SAND, medium/dark brown grading to medium brown, trace fine gravel in top 0.1', moist	SP
16					Bottom of boring	
18						
20						

NR = Not reported

Harding Lawson Associates



Project: NCBC Gulfport Site 8A

Site ID: GB-13

Project No: 44236 0254062

Comp. Date: 12/9/99

Logged By: Deven Carigan

Contractor: Pensacola Testing

Driller: Matt Howard

Drill Method: 6" OD HSA

Rig Type: Diedrich 25

Total Depth: 15 ft. bgs

Depth To Water: 3.3 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
1	1	48	1, 3, 3		Top 0.4' Loose ASH, dry Bottom 0.3' Loose fine SAND, yellow-tan, some silt, moist	SM
2						
4						
6	2	80	9, 7, 10		Medium dense fine SAND, grading from tan to pinkish light brown, little silt, moist	SP
8						
10	3	100	7, 9, 13		Medium dense fine SILTY SAND, dark brown	SM
12						
14	4	NR	9, 10, 13		Medium dense to dense fine SAND, dark brown, trace silt, moist	SP
16					Bottom of boring	
18						
20						

NR = Not reported

Harding Lawson Associates



Project: NCBC Gulfport Site 8Annex

Site ID: GB-14

Project No: 44236 0254062

Comp. Date: 12/8/99

Logged By: Deven Carigan

Contractor: Pensacola Testing

Driller: Matt Howard

Drill Method: 6" OD HSA

Rig Type: Diedrich 25

Total Depth: 15 ft. bgs

Depth To Water: 5.4 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
0.0 - 1.2'	1	100	11, 5, 4		Loose fine SAND, mottled light gray, light brown-orange and dark gray, trace silt, slightly moist	SP
1.2 - 1.5'					Loose fine SILTY SAND, black	SM
2						
4						
6	2	67	2, 5, 5		Loose to medium dense fine SAND, light gray ranging to medium gray, some silt, moist	SM
8					↑ Note: One of these had a small ~0.1' band containing >50% fine gravel ↓	
10	3	100	3, 4, 5		Loose fine SAND, grading from dark to medium brown, little to some silt, moist to wet, odor	SP
12						
14	4	100	9, 11, 14		13.5 - 14.7' Medium dense fine SAND, light/medium brown, trace to some fine sub-rounded gravel	SP
					14.7 - 15.0' Same with silt	SM
16					Bottom of boring	
18						
20						

Harding Lawson Associates

Project: NCBC Gulfport Site 8AnnexSite ID: GB-15Project No: 44236 0254062Comp. Date: 12/8/99Logged By: Deven CariganContractor: Pensacola TestingDriller: Matt HowardDrill Method: 6" OD HSARig Type: Diedrich 25Total Depth: 15 ft. bgsDepth To Water: 4.4 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
1	1	60	10, 5, 3		Medium stiff SILT, medium gray to dark brown/gray, trace to little fine sand, trace pinkish rock material, trace wood fragments	ML
2						
4						
6	2	60	6, 6, 9		Top portion of sample is a large chunk of wood. Medium dense fine SILTY SAND, medium gray, moist, odor	SM
8						
10	3	100	9, 12, 13		Medium dense fine SAND, dark brown, trace silt, odor	SP
12						
14	4	100	6, 8, 14		Medium dense, fine SAND, medium/dark brown, trace coarse sand, trace wood, moist	SP
16					Bottom of boring	
18						
20						

Harding Lawson Associates



Project: NCBC Gulfport Site 8B

Site ID: GB-16

Project No: 44236 0254062

Comp. Date: 12/6/99

Logged By: Deven Carigan

Contractor: Pensacola Testing

Driller: Matt Howard

Drill Method: 6" OD HSA

Rig Type: Diedrich 25

Total Depth: 16 ft. bgs

Depth To Water: 4.0 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	QVM Reading (ppm)	Material Description	USCS (observed)
1	1	85	10, 7, 5, 7		<u>Top 0.7'</u> Medium dense medium SAND, medium brown, dry <u>Next 1.0'</u> Medium dense medium SAND, trace to some clay, slightly moist	SP
2	2	82	4, 6, 7, 18		<u>Top 1.0'</u> Medium dense fine CLAYEY SAND <u>Next 0.7'</u> Loose fine SAND, light gray, moist	SC SP
4	3	65	10, 12, 12, 16		Loose fine SAND, light gray, moist	SP
6	4	88	6, 12, 13, 11		<u>Top 1.1'</u> Medium dense medium SAND, light gray, trace black debris and fine sub-angular gravel, wet <u>Next 0.7'</u> Medium dense fine SAND, black, some silt, trace sub-angular gravel	SP SM
8	5	85	3, 3, 1, 5		<u>Top 0.35'</u> Loose fine SAND, light gray, some silt, wet <u>Next 1.4'</u> Very loose SAND, black, trace silt, trace fine sub-rounded gravel, very wet	SM SP
10	6	95	2, 5, 12, 15		Medium dense fine SILTY SAND, very dark brown, trace fine rounded gravel, little to some medium grained light gray sand mixed throughout, very wet	SM
12	7	100	NR		<u>12.0 - 12.9'</u> Continuation of above <u>12.9 - 14.0'</u> Medium dense fine SILTY SAND, very dark brown, wet	SM
14	8	100	3, 5, 11, 12		<u>14.0 - 14.6'</u> Medium dense fine to medium SAND, very dark brown, trace sub-rounded gravel, wet <u>14.6 - 16.0'</u> Medium dense fine SAND, dark brown, some fine sub-angular gravel	SW SP
16					Bottom of boring	
18						
20						

NR = Not reported

Harding Lawson Associates

Project: NCBC Gulfport Site 8BSite ID: GB-17Project No: 44236 0254062Comp. Date: 12/7/99Logged By: Deven CariganContractor: Pensacola TestingDriller: Matt HowardDrill Method: 6" OD HSARig Type: Diedrich 25Total Depth: 15 ft. bgsDepth To Water: 3.5 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
1	1	87	12, 6, 7		Top 0.6' Dense fine SANDY SILT, light gray/tan Next 0.7' Medium dense, same as above	ML
2						
4						
6	2	73	4, 5, 7		Medium dense fine SAND, wet	SP
8						
10	3	100	7, 7, 9		Medium dense fine SILTY SAND, dark brown, little fine rounded gravel, trace coarse sand, wet	SM
12						
14	4	100	4, 6, 6		Same as above	SM
16					Bottom of boring	
18						
20						

Harding Lawson Associates



Project: NCBC Gulfport Site 8B

Site ID: GB-19

Project No: 44236 0254062

Comp. Date: 12/7/99

Logged By: Deven Carigan

Contractor: Pensacola Testing

Driller: Matt Howard

Drill Method: 6" OD HSA

Rig Type: Diedrich 25

Total Depth: 15 ft. bgs

Depth To Water: 5 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	QVM Reading (ppm)	Material Description	USCS (observed)
1	1	90	9, 7, 5		Top 0.35' Stiff CLAYEY SILT, mottled medium brown, tan and black, low moisture Bottom 1.0' Medium dense fine SILTY SAND, light gray/tan, low moisture	ML SM
2						
4						
6	2	93	6, 7, 8		Top 0.3' Medium dense fine SILTY SAND, medium orange-brown, low moisture Next 0.4' Medium dense fine SAND, light gray, moist Next 0.7' Medium dense fine SILTY SAND, black/dark brown, wet, odor	SM SP SM
8						
10	3	100	8, 10, 10		Medium dense fine SILTY SAND, some fine gravel, wet, odor	SM
12						
14	4	100	7, 8, 9		Loose fine SILTY SAND, dark brown, trace fine sub-rounded gravel, wet, odor	SM
16					Bottom of boring	
18						
20						

Harding Lawson Associates



Project: NCBC Gulfport Site 8B

Site ID: GB-21

Project No: 44236 0254062

Comp. Date: 12/7/99

Logged By: Deven Carigan

Contractor: Pensacola Testing

Driller: Matt Howard

Drill Method: 6" OD HSA

Rig Type: Diedrich 25

Total Depth: 16 ft. bgs

Depth To Water: 4 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
1	1	100	16, 8, 7, 7		0.0 - 1.7' Stiff SILT, light gray mottled with some orange and brown, trace clay, dry	ML
2					1.7 - 2.0' Medium dense fine SILTY SAND, light gray, slightly moist	SM
3	2	80	3, 6, 6, 8		Medium dense fine SILTY SAND, light gray, trace clay, slightly moist, moisture and grain size increase with depth	SM
4						
5	3	95	3, 7, 9, 11		Top 1.0' Medium dense fine SAND, medium and dark brown, some silt, trace medium sand, trace clay, very moist	SM
6					Bottom 0.9' Medium dense fine SAND, light tan, wet	
7	4	100	7, 12, 14, 18		Medium dense fine SAND, light tan, grading to medium sand in bottom 0.3', wet	SW
8						
9	5	100	4, 8, 12, 21		8.0 - 8.9' Medium dense fine SILTY SAND, medium gray	SM
10					8.9 - 10.0' Medium dense fine SILTY SAND, dark brown, odor	
11	6	100	2, 7, 9, 12		10.0 - 11.0' Medium dense fine SAND, medium brown, wet	SP
12					11.0 - 12.0' Medium dense fine SILTY SAND, dark brown, wet	SM
13	7	100	7, 12, 13, 27		12.0 - 12.9' Medium dense fine SAND, medium brown, little fine rounded gravel, moist	SP
14					12.9 - 14.0' Medium dense fine SANDY SILT, medium/dark brown, moist	ML
15	8	100	10, 19, 24, 24		14.0 - 15.2' Medium dense fine SAND, little fine rounded gravel, moist	SP
16					15.2 - 16.0' Medium dense fine SANDY SILT, dark brown, moist, odor	ML
17					Bottom of boring	
18						
19						
20						

Harding Lawson Associates

Project: NCBC Gulfport Site 8BSite ID: GB-22Project No: 44236 0254062Comp. Date: 12/7/99Logged By: Deven CariganContractor: Pensacola TestingDriller: Matt HowardDrill Method: 6" OD HSARig Type: Diedrich 25Total Depth: 15 ft. bgsDepth To Water: 4.0 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	QVM Reading (ppm)	Material Description	USCS (observed)
0	1	100	11, 6, 5		0.0 - 0.7' Medium dense fine SILTY SAND, medium gray, slightly moist 0.7 - 1.5' Medium dense fine CLAYEY SAND, light gray and light brown	ML SC
2						
4						
6	2	87	8, 7, 8		Medium dense fine SAND, medium tan/gray, trace silt, moist	SP
8						
10	3	100	4, 5, 4		Loose fine SILTY SAND, dark and medium brown, little fine rounded gravel, wet	SM
12						
14	4	73	7, 8, 10		Medium dense fine to medium SILTY SAND, medium brown, moist	SM
16					Bottom of boring	
18						
20						

Harding Lawson Associates

HILA

Project: NCBC Gulfport Site 8B

Site ID: GB-23

Project No: 44236 0254062

Comp. Date: 12/7/99

Logged By: Deven Carigan

Contractor: Pensacola Testing

Driller: Matt Howard

Drill Method: 6" OD HSA

Rig Type: Diedrich 25

Total Depth: 15 ft. bgs

Depth To Water: 3.85 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
1	1	100	13, 10, 10		0.0 - 0.9' Stiff fine SANDY SILT, medium brown 0.9 - 1.5' Medium dense fine SAND, some silt, slightly moist	ML SM
2						
4						
6	2	93	7, 7, 8		Top 0.6' Loose fine SAND, tan, trace silt, trace fine sub-rounded gravel Bottom 0.8' Medium dense fine SAND, medium brown, wet	SP
8						
10	3	87	9, 9, 10		Medium dense fine SAND, medium tan, little fine sub-rounded gravel, moist to wet	SP
12						
14	4	80	4, 3, 4		Loose fine to coarse SAND, tan, little fine sub-rounded to sub-angular gravel	SW
16					Bottom of boring	
18						
20						

Harding Lawson Associates

Project: NCBC Gulfport Site 8BSite ID: GB-25Project No: 44236 0254062Comp. Date: 12/7/99Logged By: Deven CariganContractor: Pensacola TestingDriller: Matt HowardDrill Method: 6" OD HSARig Type: Diedrich 25Total Depth: 15 ft. bgsDepth To Water: 3.85 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	OVM Reading (ppm)	Material Description	USCS (observed)
1	1	93	16, 10, 8		Top 1.3' Stiff SILT, medium gray, some fine sand, little clay, slightly moist Bottom 0.1' Fine SILTY SAND	ML SM
2						
4						
6	2	73	14, 17, 16		Medium dense fine SAND, grading from tan to light brown to medium brown, trace silt	SP
8						
10	3	100	9, 7, 6		Medium dense fine SILTY SAND, dark brown, trace fine gravel and coarse sand, moist	SM
12						
14	4	100	8, 7, 9		13.5 - 14.5' Medium dense fine SAND, medium brown, little fine sub-rounded gravel 14.5 - 15.0' Fine SAND, dark brown, trace fine gravel	SP
16					Bottom of boring	
18						
20						

Harding Lawson Associates



Project: NCBC Gulfport Site 8B

Site ID: GB-26

Project No: 44236 0254062

Comp. Date: 12/8/99

Logged By: Deven Carigan

Contractor: Pensacola Testing

Driller: Matt Howard

Drill Method: 6" OD HSA

Rig Type: Diedrich 25

Total Depth: 15 ft. bgs

Depth To Water: 4.5 ft. bgs

Depth (ft bgs)	Sequence No.	Recovery %	SPT Values	QVM Reading (ppm)	Material Description	USCS (observed)
0	1	93	12, 10, 8		0.0 - 0.9' Dense fine SAND, dark gray, trace silt, low moisture	SP
2					0.9 - 1.5' Medium dense fine SAND, mottled light gray and orange-brown, trace silt, low moisture	
4						
5	2	100	12, 6, 4		4.5 - 4.7' Loose fine SAND, medium brown, dry	SP
6					4.7 - 5.7' Medium dense fine SAND, pinkish gray, moist	
8					5.7 - 6.0' Medium dense fine SAND, black, little silt, moist	
10	3	100	10, 6, 7		9.0 - 9.3' Medium dense fine SILTY SAND, dark brown, moist	SM SP
12					9.3 - 9.7' Dense fine SILTY SAND, dark brown, moist	
14					9.7 - 10.5' Medium dense fine SAND, medium/dark brown, little silt, trace fine sub-rounded gravel, moist to wet	
14	4	100	4, 5, 8		Medium dense fine SAND, medium brown, trace to little fine gravel, trace coarse sand, trace silt, moist to wet	SW
16					Bottom of boring	
18						
20						

Harding Lawson Associates

Job No.	Client No.	PO No.	Report No.	Date	Page
99-132	-		20960	12/24/99	1 of 4

REPORT OF: CALIFORNIA BEARING RATIO (CBR) TESTING (ASTM D1883)

For: Harding Lawson Associates
1400 Centerpoint Boulevard, #158
Knoxville, TN 37932

Dates of Service: 12/20 to 12/24/99
Technicians: B.H. & R.B.

Attn:

Project: NCBC
Gulfport, MS

Sample Identification: Boring GB-9

Sampled by: PTL / M.Howard

Date Delivered to Lab: 12/10/99

Sample I.D. - Brown Sand

CBR Test Results:

<u>MOISTURE CONTENT, % BY DRY WT.</u>	<u>DRY DENSITY, PCF</u>	<u>% OF MAXIMUM DRY DENSITY (ASTM D698)</u>	<u>CBR @ 0.1" PENETRATION</u>	<u>CBR @ 0.2" PENETRATION</u>
12.5	102.8	97.9	6.8	7.5
12.5	103.7	98.8	9.8	11.1
12.5	105.0	100.0	13.2	13.7

Surcharge Used: 10 lbs.

Condition of sample at penetration: Soaked

Testing performed in general accordance with ASTM D1883.

By: _____

Ptha Wheeler

Job Number	Client Number	P.O. Number	Report Number	Date	Page
99-132	-		20960	12/20/99	2 of 4

REPORT OF: PROCTOR DENSITY OF SOIL

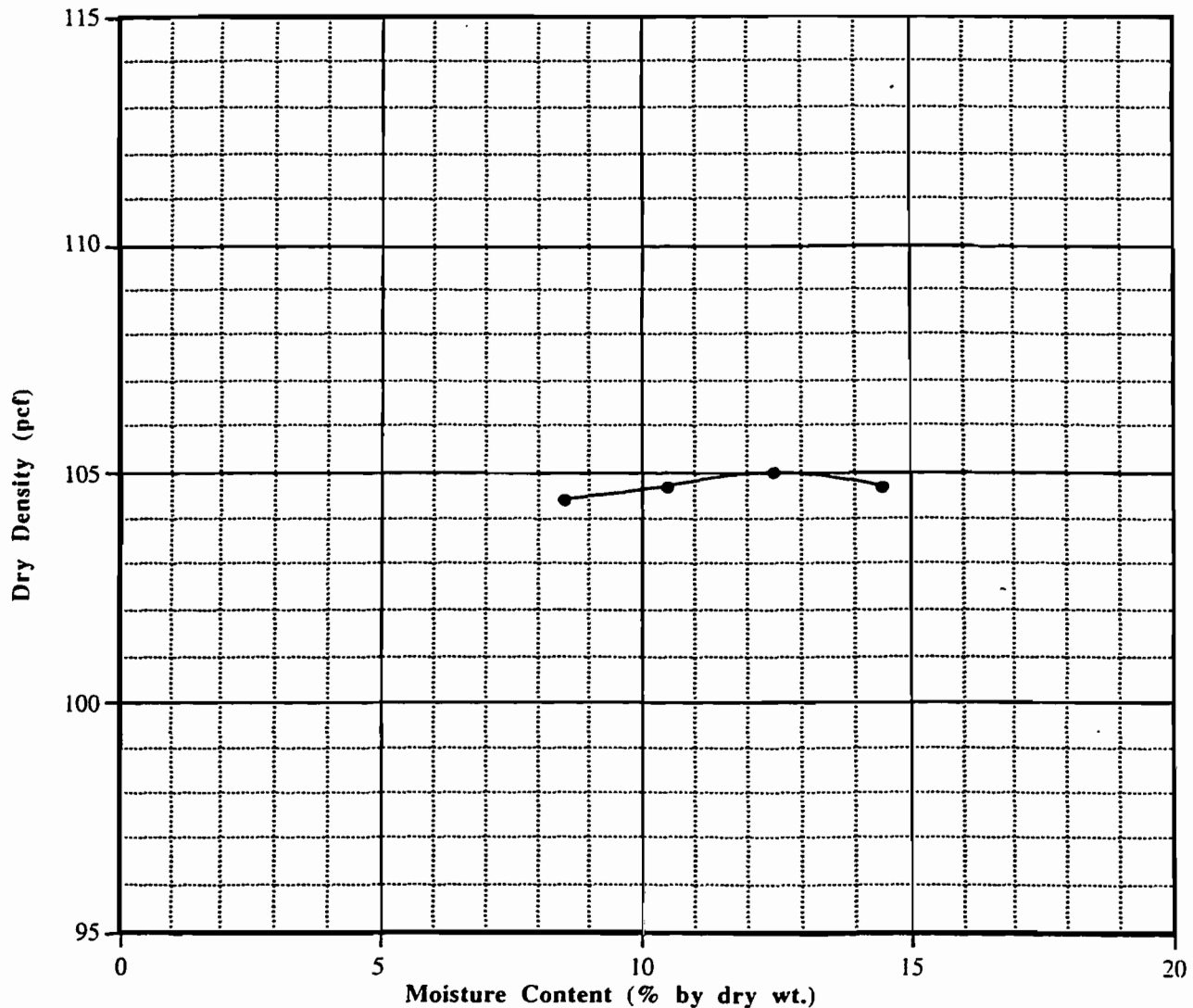
For: Harding Lawson Associates
1400 Centerpoint Boulevard, #158
Knoxville, TN 37932
Att:

cc:

Project: NCBC Gulfport, MS	Sampled/Deliv. By: PTL - M.H.	Date: 12/10/99
Sampled From: Boring GB-9	Pit Name: ---	Pit No: ---
Pit Location: ---	% Passing #200 Screen:	Soil Classification:
Soil Descript. & Color: Brown Sand	Applicable Specs: ASTM D1883	

Comments:

Maximum Density (Dry): **105.0** Lbs. Ft³ @ An Optimum Moisture Of: **12.6** %



Reports To:

Reviewed By PAW

By:

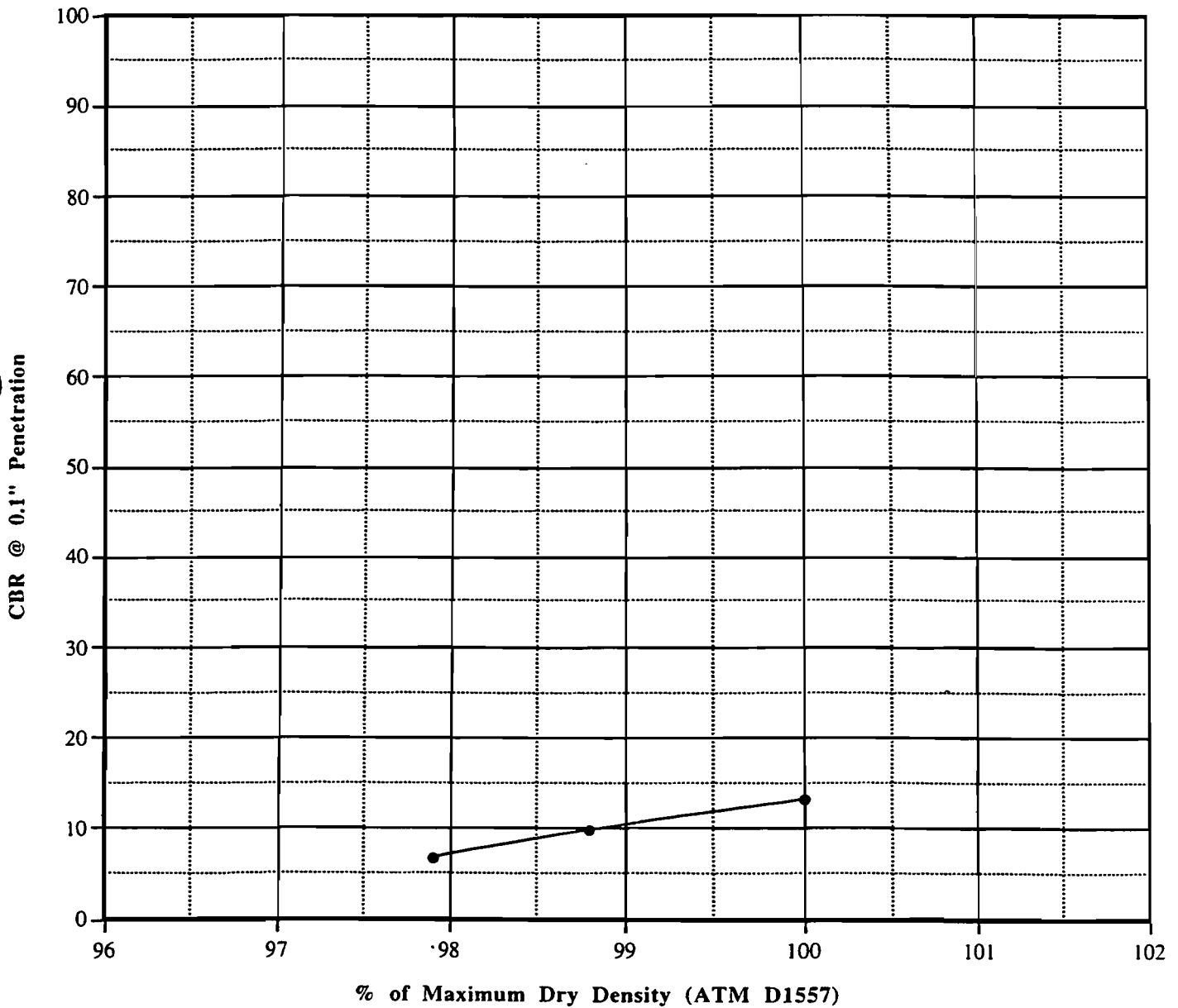
Patricia A. Wheeler

Job No.	Client No.	P.O. No.	Report No.	Date	Page
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REPORT OF: CALIFORNIA BEARING RATIO (CBR) TESTING (ASTM D1883)

For: Harding Lawson Associates

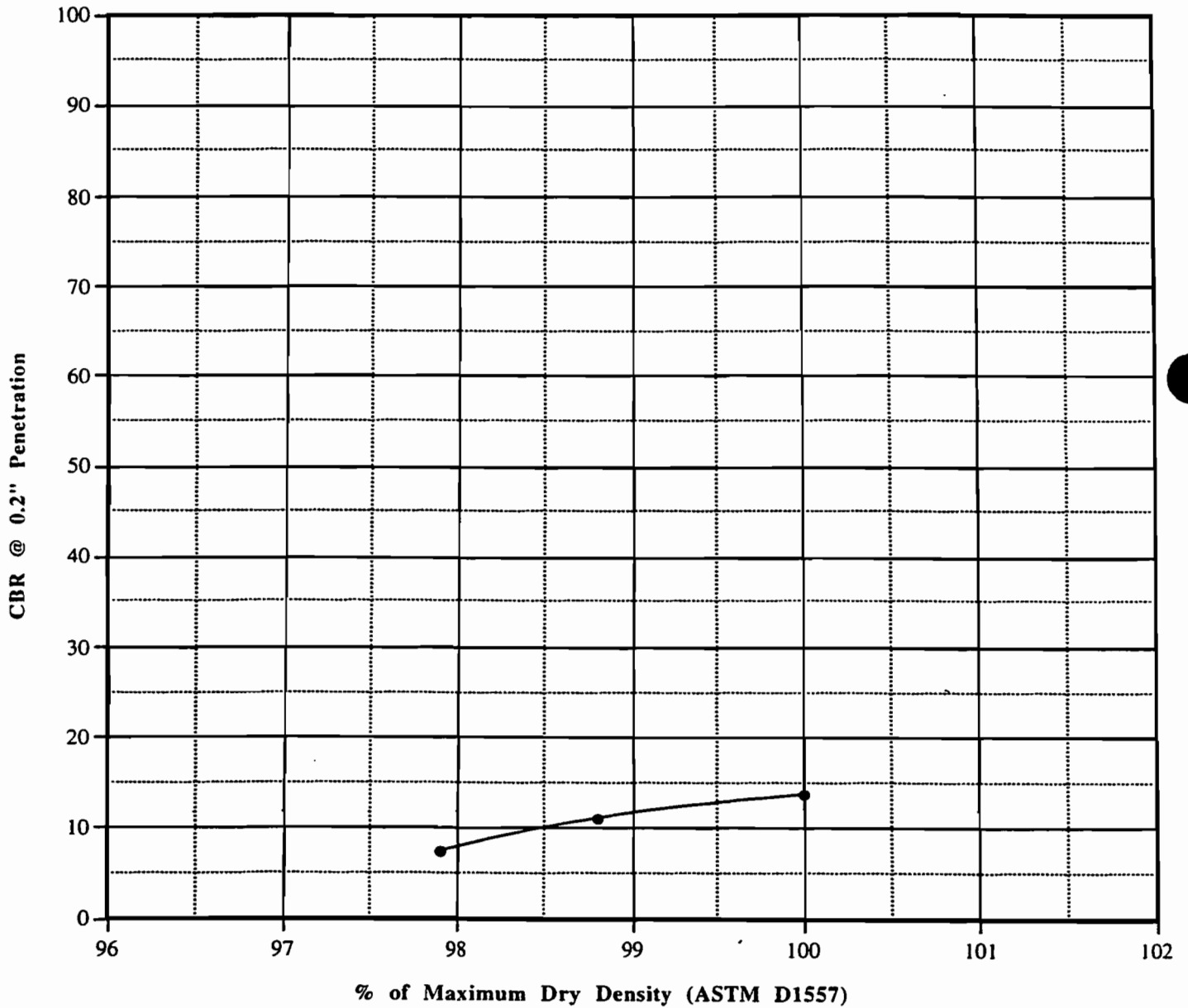
Project: NCBC, Gulfport, MS



Job No.	Client No.	P.O. No.	Report No.	Date	Page
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REPORT OF: CALIFORNIA BEARING RATIO (CBR) TESTING (ASTM D1883)

For: Harding Lawson Associates
Project: NCBC, Gulfport, MS



REPORT OF: Soil Classification Analyses

File No.	Job No.	PO No:	Report No	Date	Page
99-132	-	-	78774-1	Dec 22, 1999	1 of 31

Project: NCBC Gulfport

For Harding Lawson Associates
1400 Centerpoint Blvd., #158
Knoxville, TN 37932

Att:

Samples Submitted by Client: ☐Samples Taken By PTL: ☒

Submit/Taken, Date: 12/6-12/10/99

LL, PL, PI & Sieve Analysis % Passing (By Wt.)

Samp#	Sample I.D.	LL	PL	PI	#10	#20	#40	#80	#200	Class
GB-1 0-1.5'	LIGHT BROWN SILTY SAND	19	16	3	100	99.7	95.0	24.2	18.2	SM
GB-8 2'-4'	TAN POORLY GRADED SAND			NP	100	99.1	86.0	4.8	2.1	SP
GB-12 4.5'-6'	TAN POORLY GRADED SAND			NP	99.9	99.8	86.7	7.3	2.9	SP
GB-13 13.5'-15'	BROWN POORLY GRADED SAND			NP	98.0	94.4	77.2	10.5	2.7	SP
GB-8 10'-12'	BROWN POORLY GRADED SAND			NP	94.1	90.1	78.6	13.3	2.2	SP
GB-16 10'	TAN AND BROWN POORLY GRADED SAND			NP	99.0	91.7	57.4	6.8	2.5	SP
GB-21 6'-8'	TAN POORLY GRADED SAND			NP	98.9	97.6	75.8	5.1	2.3	SP
ASH-1	BLACK ASH			NP	86.1	80.6	67.6	19.5	12.9	..
ASH-2	BLACK ASH			NP	94.7	90.9	76.0	15.7	10.2	..
GS-1	BROWN SILTY SAND	25	24	1	96.6	92.6	77.1	16.9	13.7	SM*
GS-2	BROWN SILTY SAND	52	30	22	95.7	94.2	88.6	37.8	31.7	SM*
GS-3	BROWN LEAN CLAY	47	25	22	99.6	99.5	99.4	98.0	95.6	CL*
GS-4	LIGHT BROWN SILTY SAND			NP	99.1	96.1	81.3	27.3	16.9	SM*
GS-5	BROWN SILTY SAND	17	15	2	99.6	99.0	95.0	33.9	22.2	SM*
GS-6	BROWN SILTY SAND	17	15	2	99.9	99.2	81.4	32.9	27.0	SM*
GS-7	BROWN SILTY CLAYEY SAND	27	20	7	99.9	99.7	97.0	48.2	27.4	SC-SM*
GS-8	BROWN GREY SILTY CLAYEY SAND	25	20	5	99.9	99.7	98.9	83.8	31.8	SC-SM*
GS-9	DARK BROWN ELASTIC SILT WITH SAND	61	35	26	98.7	96.9	95.3	92.6	77.8	MH*
GS-10	BROWN SILT WITH SAND	48	29	19	99.8	99.5	98.8	93.2	70.3	ML*
GS-11	DARK BROWN SANDY ELASTIC SILT	75	38	37	99.3	97.0	93.3	85.7	65.6	MH*

Tested By: RRC, PW, BH, TD

Comments

Samples were washed over #200 sieve.

*Wood particles, small roots and other organics were visually evident.

**Based on sample identification (ASH) and appearance, it is not certain that a Unified Soil Classification is appropriate for the material tested.

NP: Non-Plastic

Reports To: 1 - Harding Lawson Associates

By

P. H. A. W. H.

REPORT OF: Soil Classification Analyses

File No.	Job No.	PO No:	Report No	Date	Page
99-132	-	-	78774-1	Dec 22, 1999	2 of 31

Project: NCBC Gulfport

For Harding Lawson Associates
1400 Centerpoint Blvd., #158
Knoxville, TN 37932
Att:

Samples Submitted by Client: ☐Samples Taken By PTL: ☒

Submit/Taken, Date: 12/6-12/10/99

LL, PL, PI & Sieve Analysis % Passing (By Wt.)

Samp#	Sample I.D.	LL	PL	PI	#10	#20	#40	#80	#200	Class
GS-12	LIGHT BROWN SILTY SAND	21	18	3	100	99.8	99.2	88.3	44.2	SM
GS-13	DARK BROWN ELASTIC SILT	95	52	43	97.3	94.0	91.0	87.5	73.7	MH*
GS-14	DARK BROWN SILTY SAND	39	26	13	98.2	94.7	89.7	67.1	27.0	SM*
GS-15	DARK BROWN SANDY SILT	49	28	21	99.9	99.6	98.4	88.7	63.0	ML*
GS-16	DARK BROWN SANDY ELASTIC SILT	62	33	29	99.8	99.7	98.2	86.2	68.2	MH*
GS-17	BROWN GREY SILTY SAND	20	18	2	99.2	98.2	95.9	58.1	26.3	SM*
GS-18	BROWN SILTY SAND	27	22	5	99.8	99.3	66.0	45.6	22.6	SM*
GS-19	BROWN SANDY ELASTIC SILT	94	44	50	93.8	77.4	66.7	64.0	61.9	MH*
GS-20	BROWN CLAYEY SAND	33	20	13	99.9	99.4	97.8	82.1	35.8	SC*

Tested By: RRC, PW, BH, TD

Comments

Samples were washed over #200 sieve.

*Wood particles, small roots and other organics were visually evident.

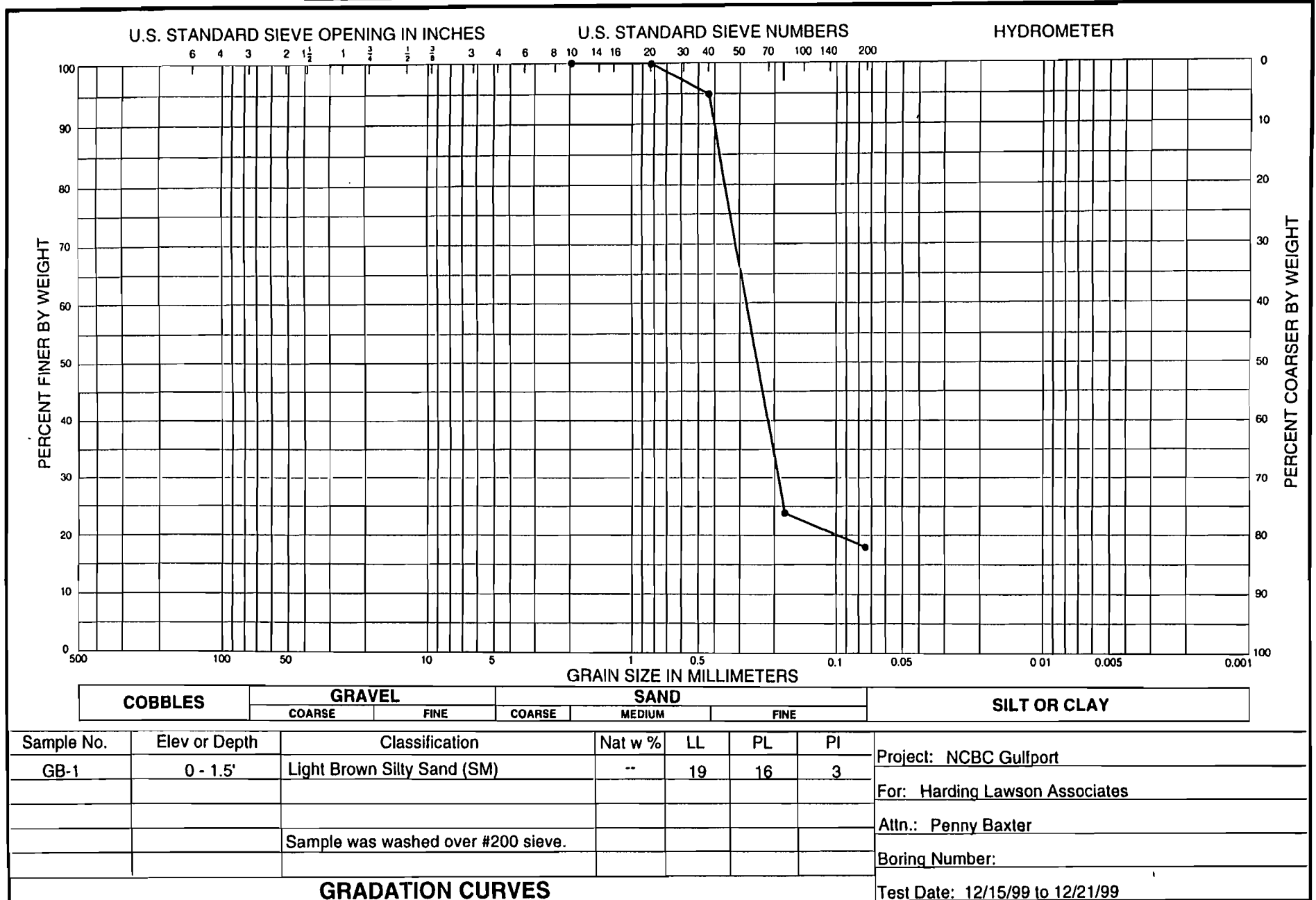
**Based on sample identification (ASH) and appearance, it is not certain that a Unified Soil Classification is appropriate for the material tested.

Reports To: 1 - Harding Lawson Associates

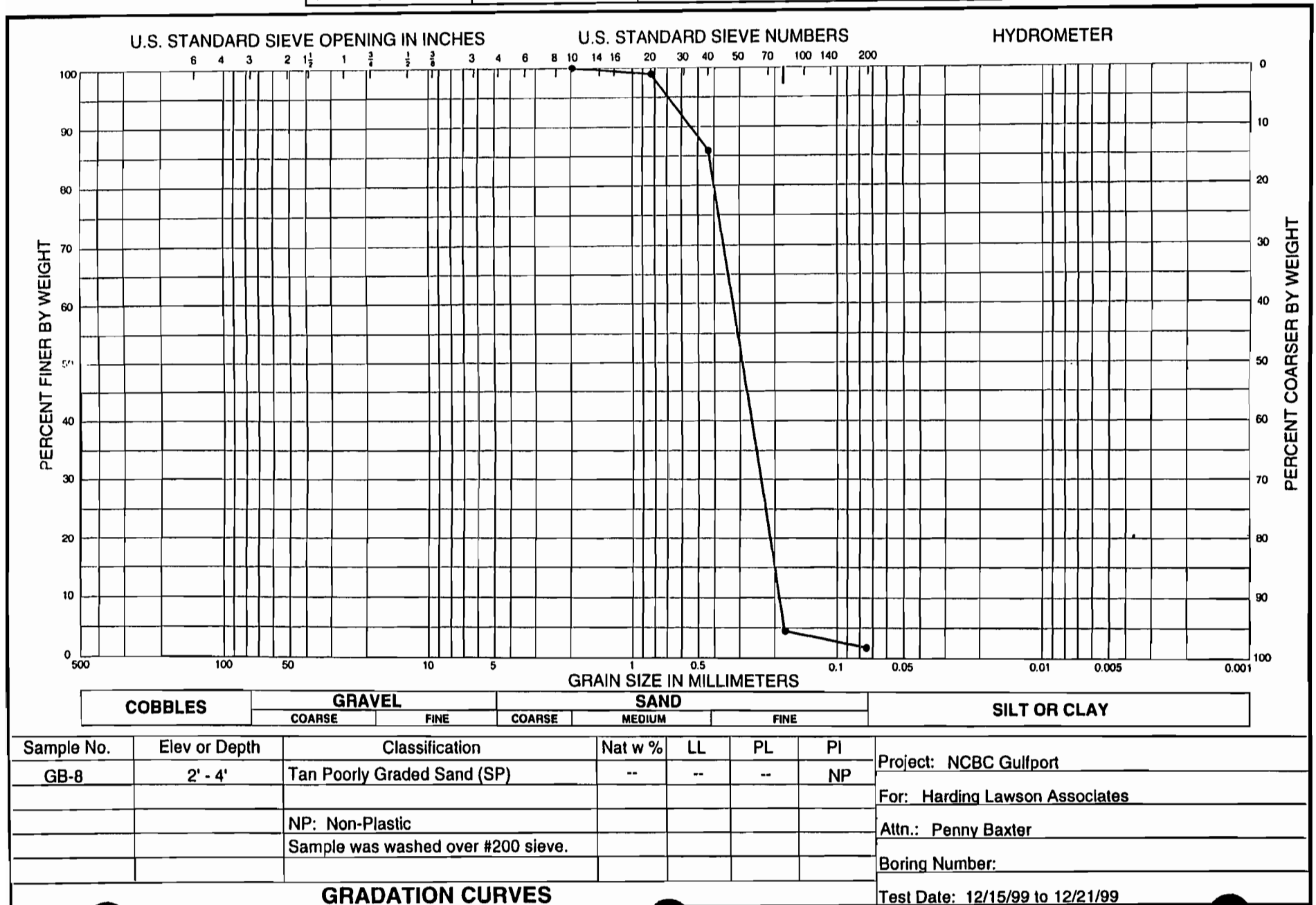
By



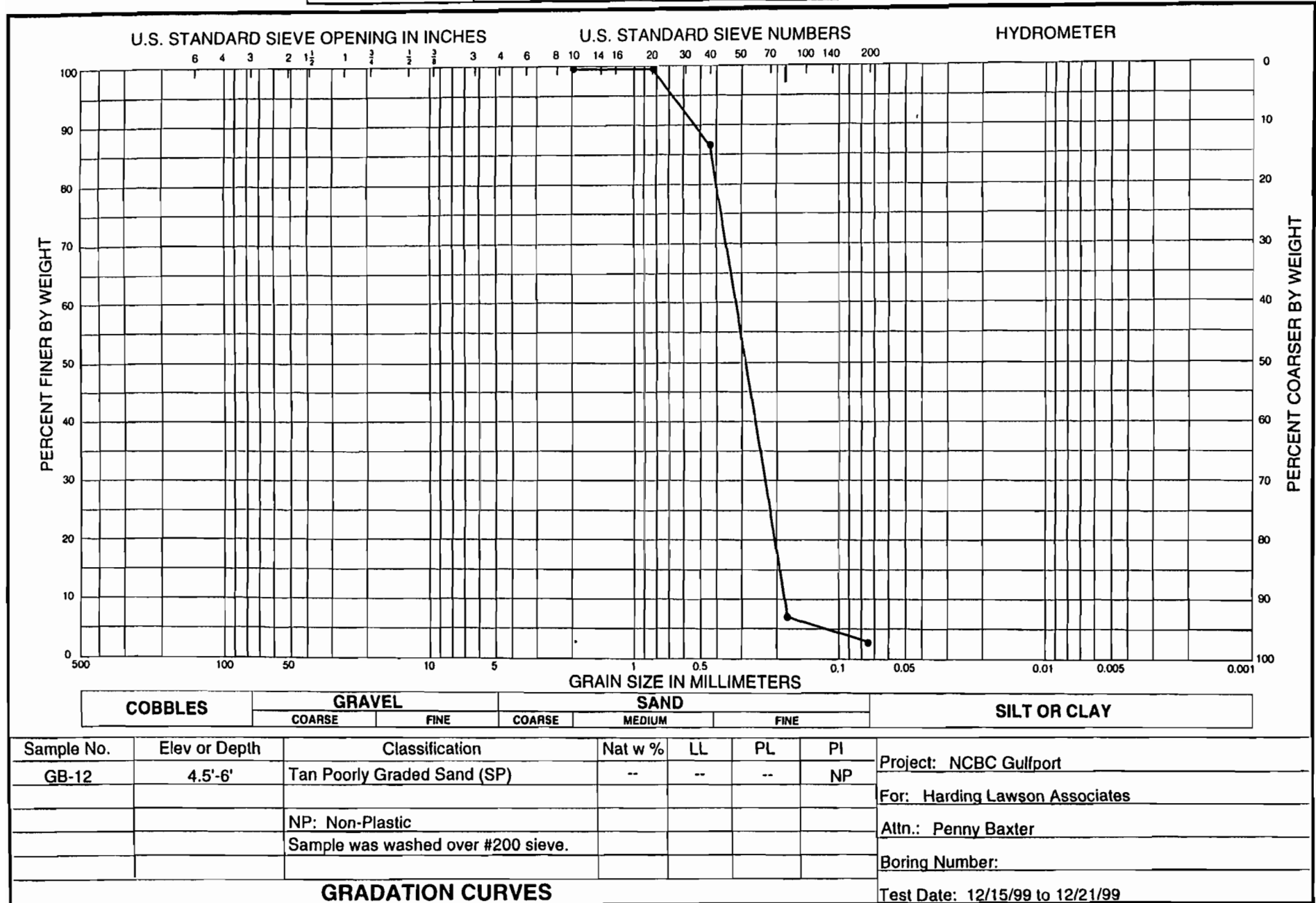
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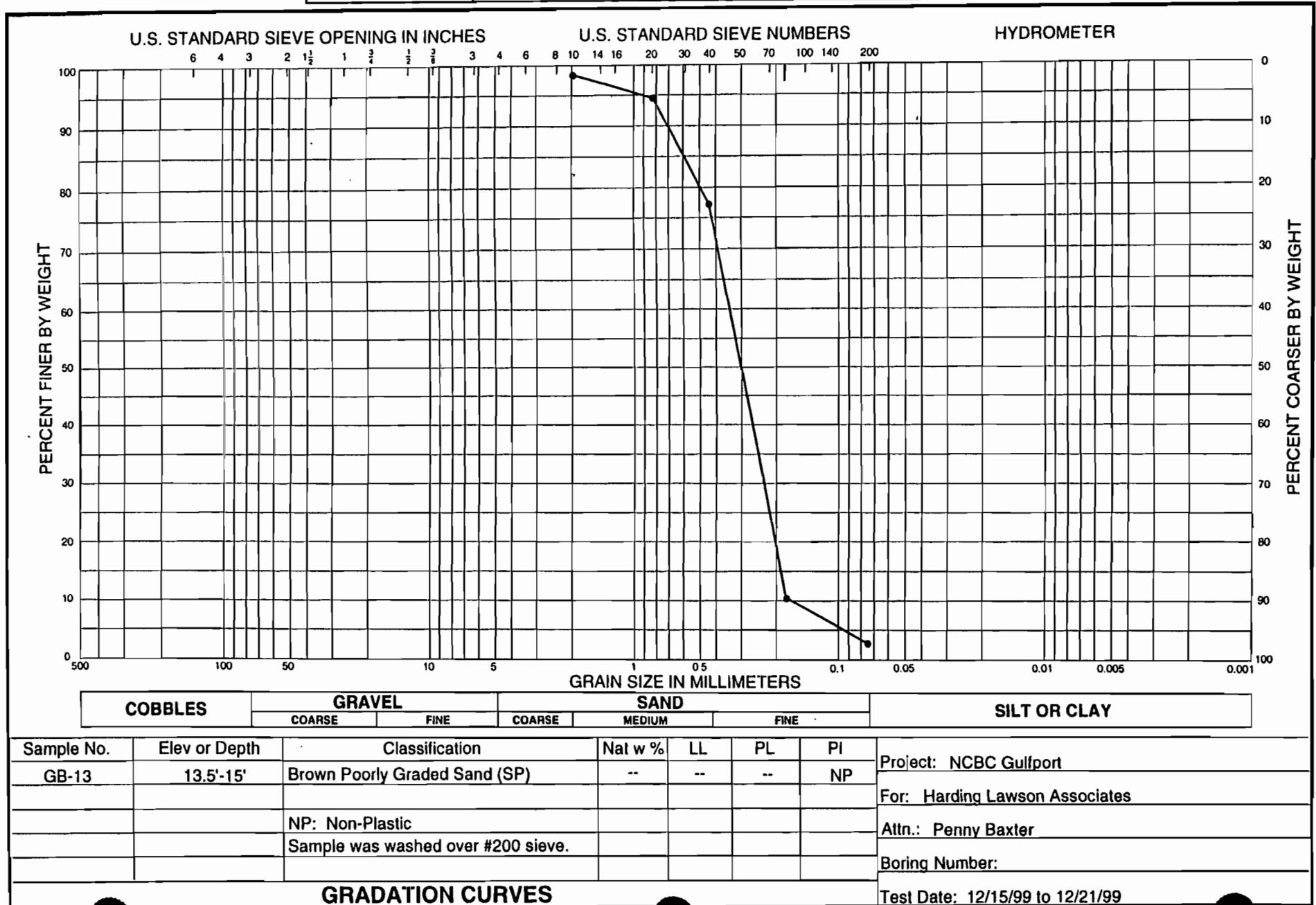
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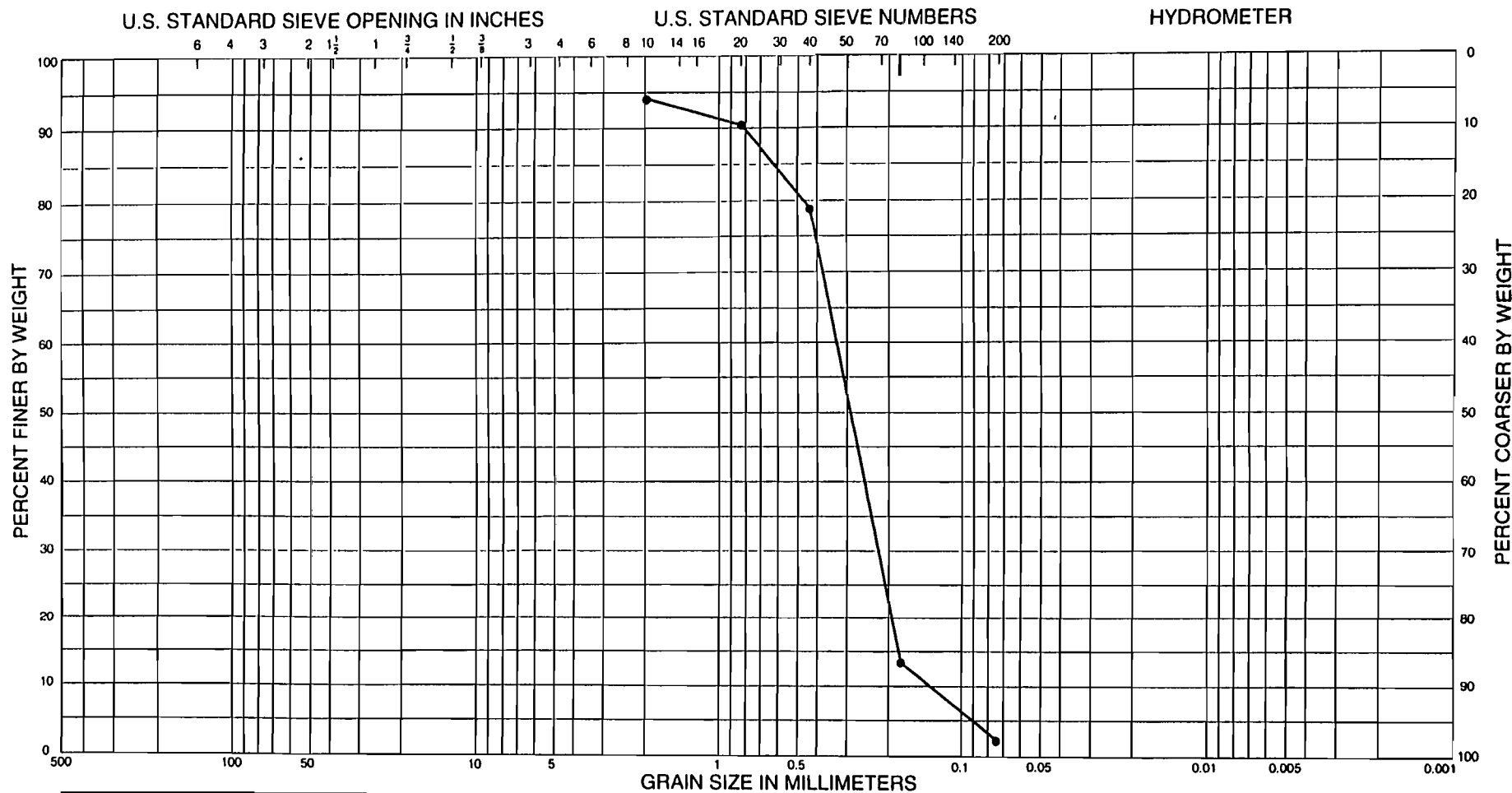
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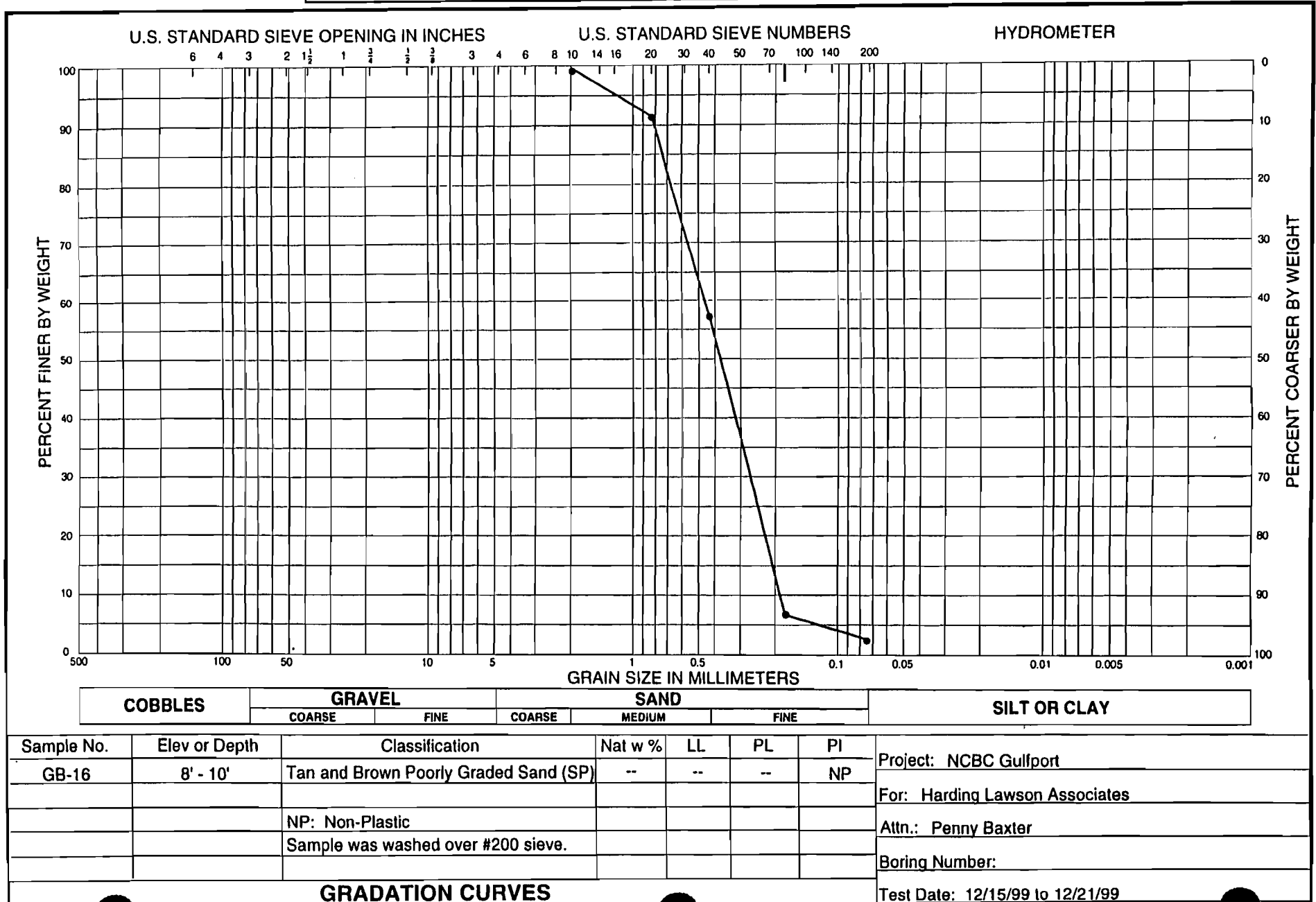


COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI	
GB-8	10' - 12'	Brown Poorly Graded Sand (SP)	--	--	--	NP	Project: NCBC Gulfport
							For: Harding Lawson Associates
		NP: Non-Plastic					Attn.: Penny Baxter
		Sample was washed over #200 sieve.					Boring Number:
							Test Date: 12/15/99 to 12/21/99

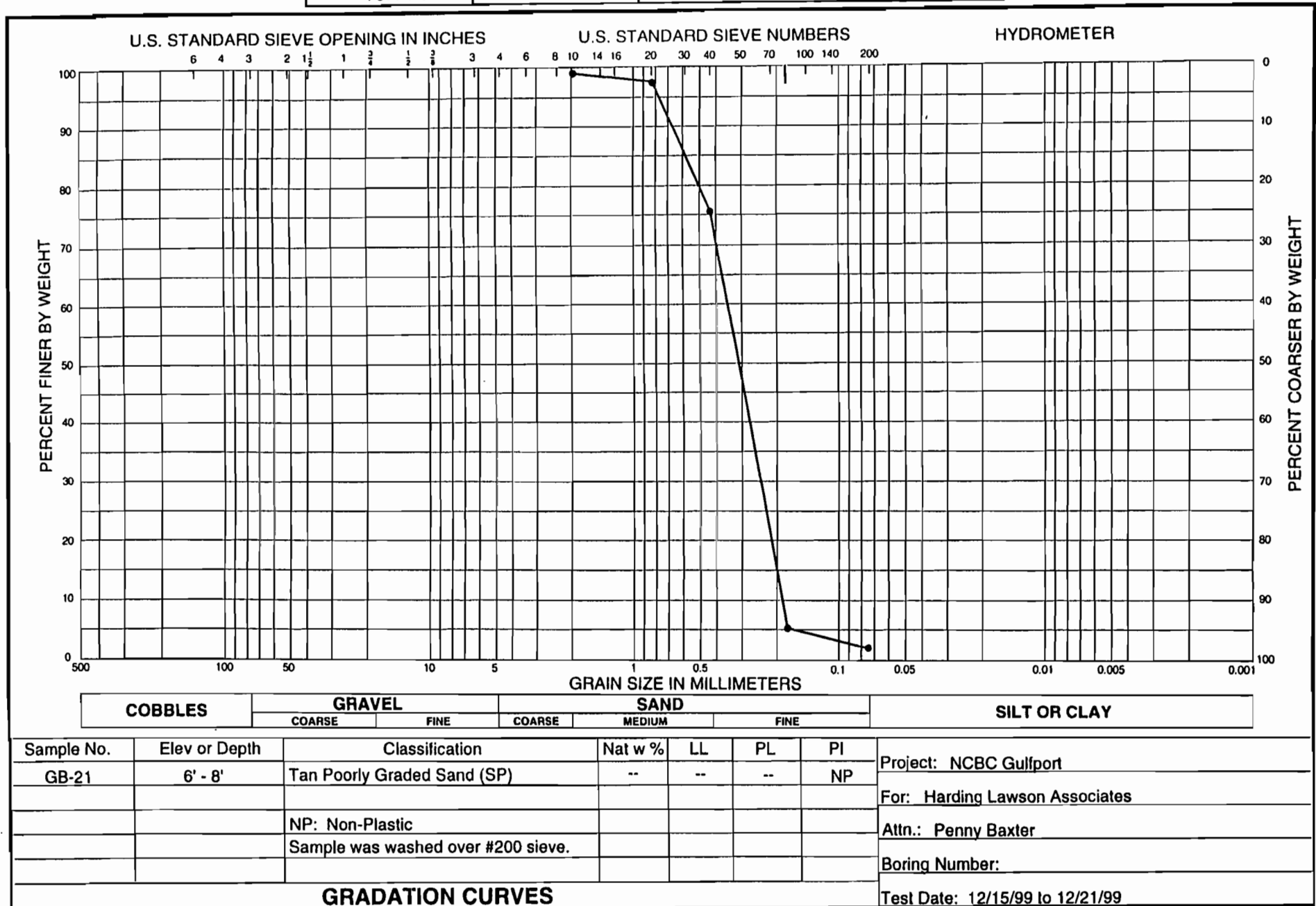
GRADATION CURVES

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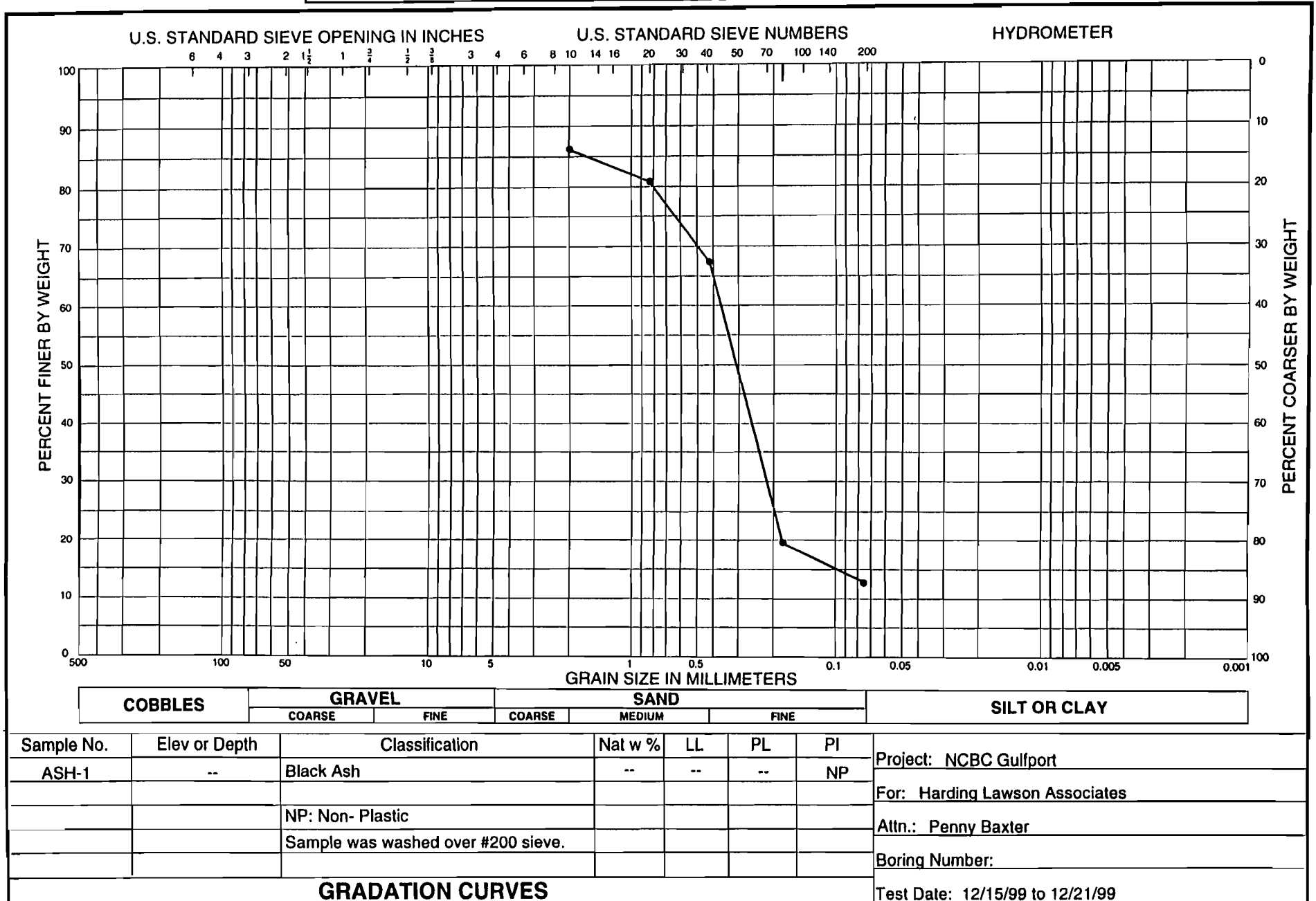


GRADATION CURVES

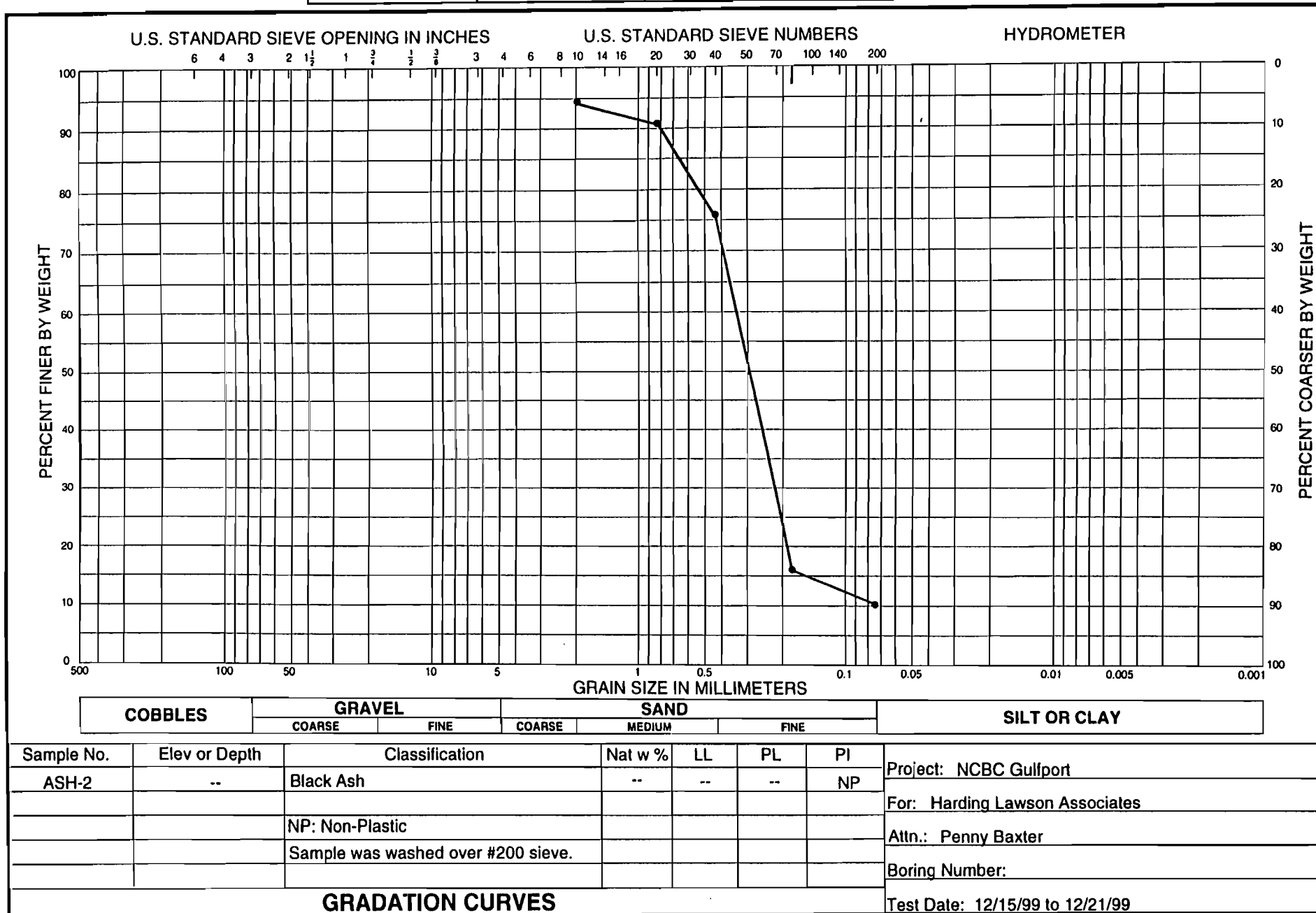
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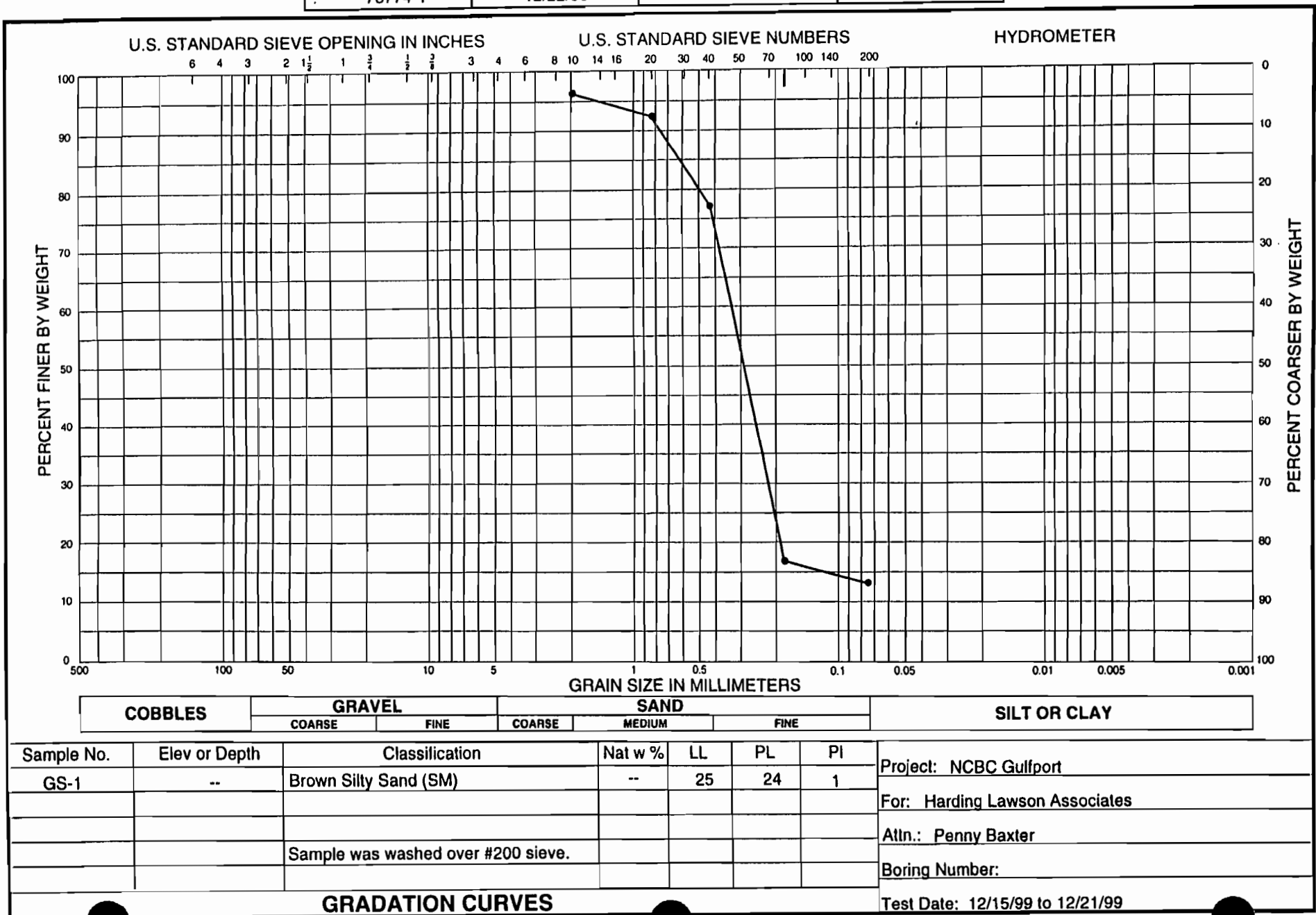
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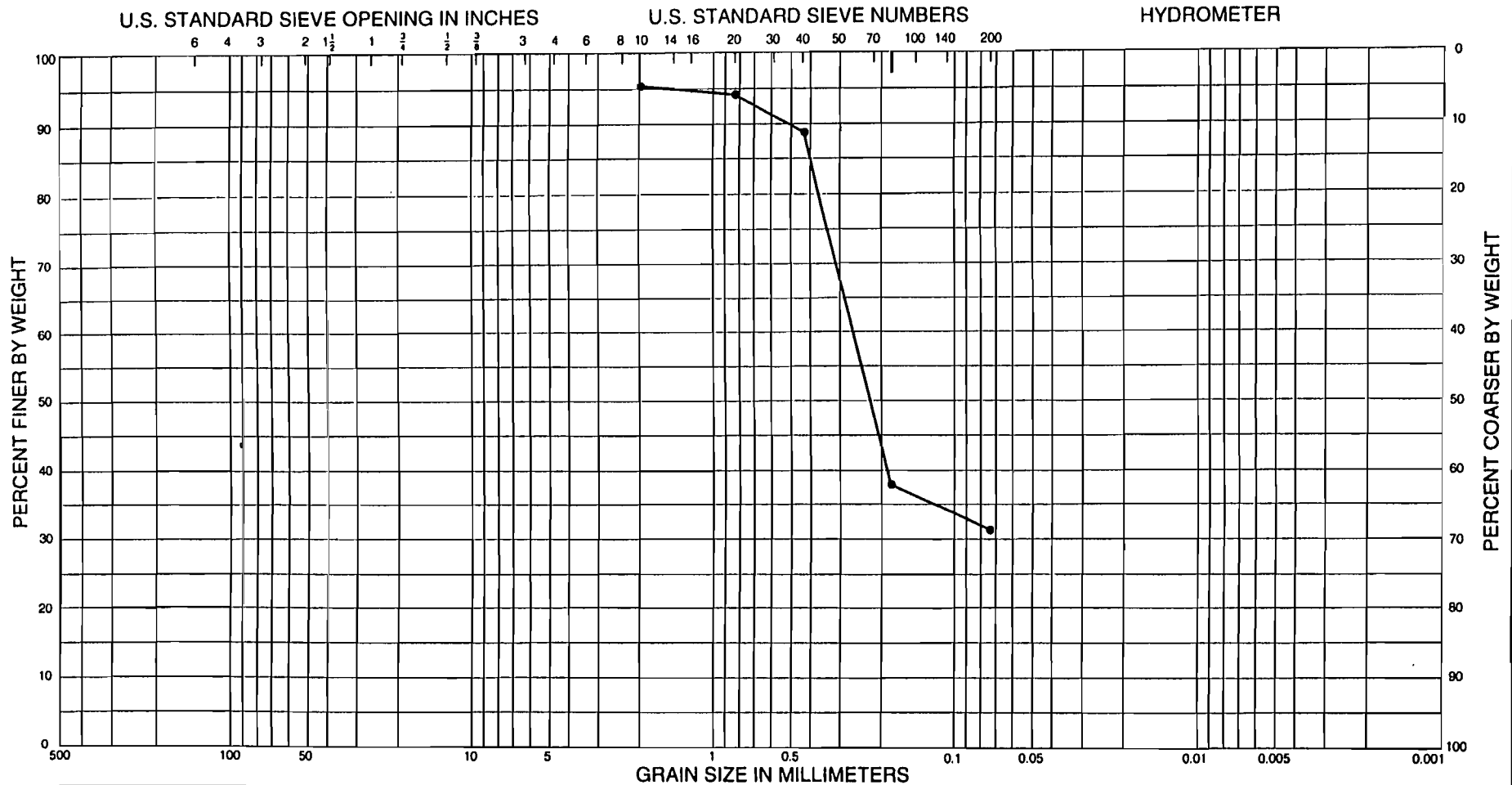
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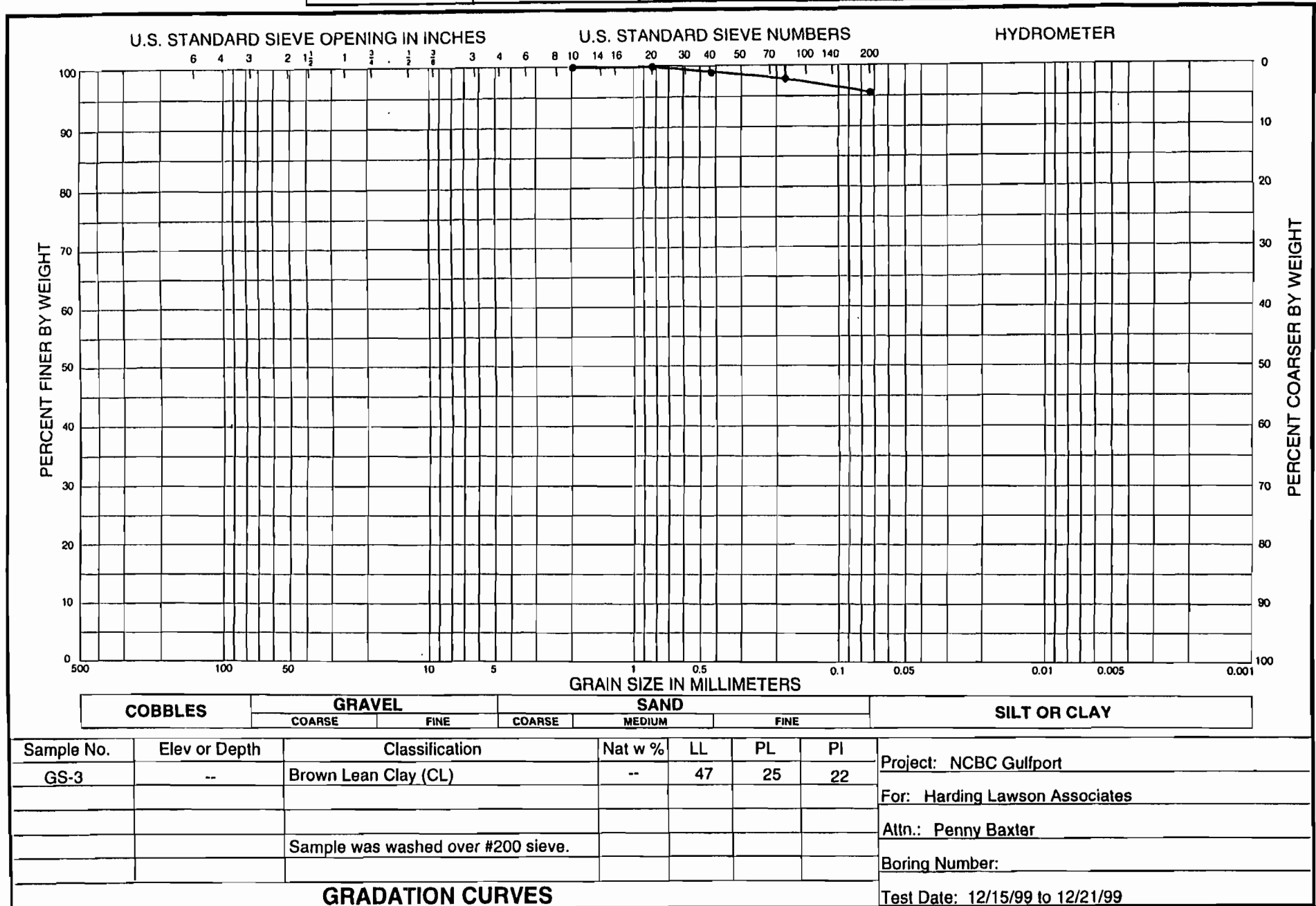


COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

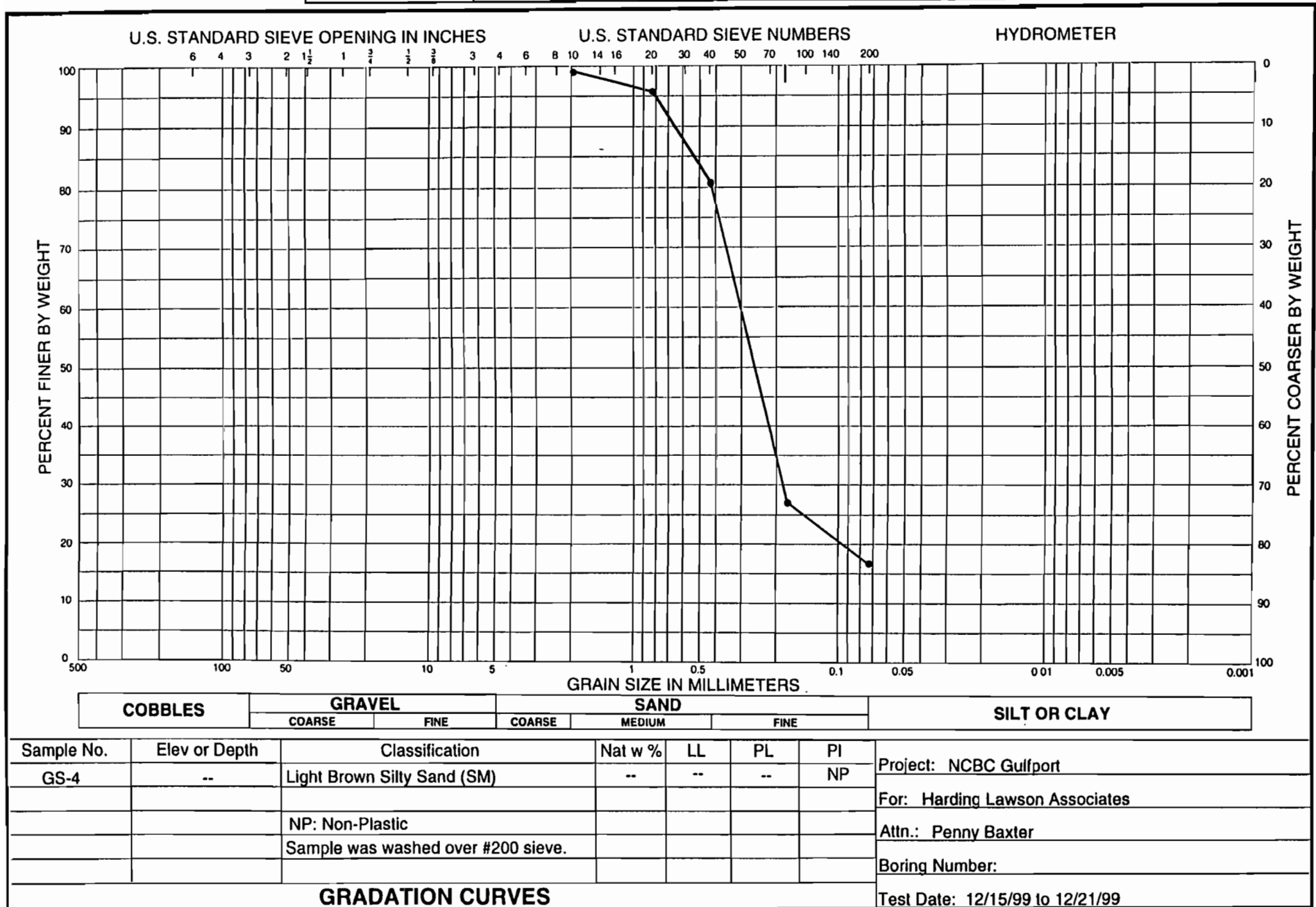
Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI	Project: NCBC Gulfport For: Harding Lawson Associates Attn.: Penny Baxter Boring Number: Test Date: 12/15/99 to 12/21/99
GS-2	--	Brown Silty Sand (SM)	--	52	30	22	
		Sample was washed over #200 sieve.					

GRADATION CURVES

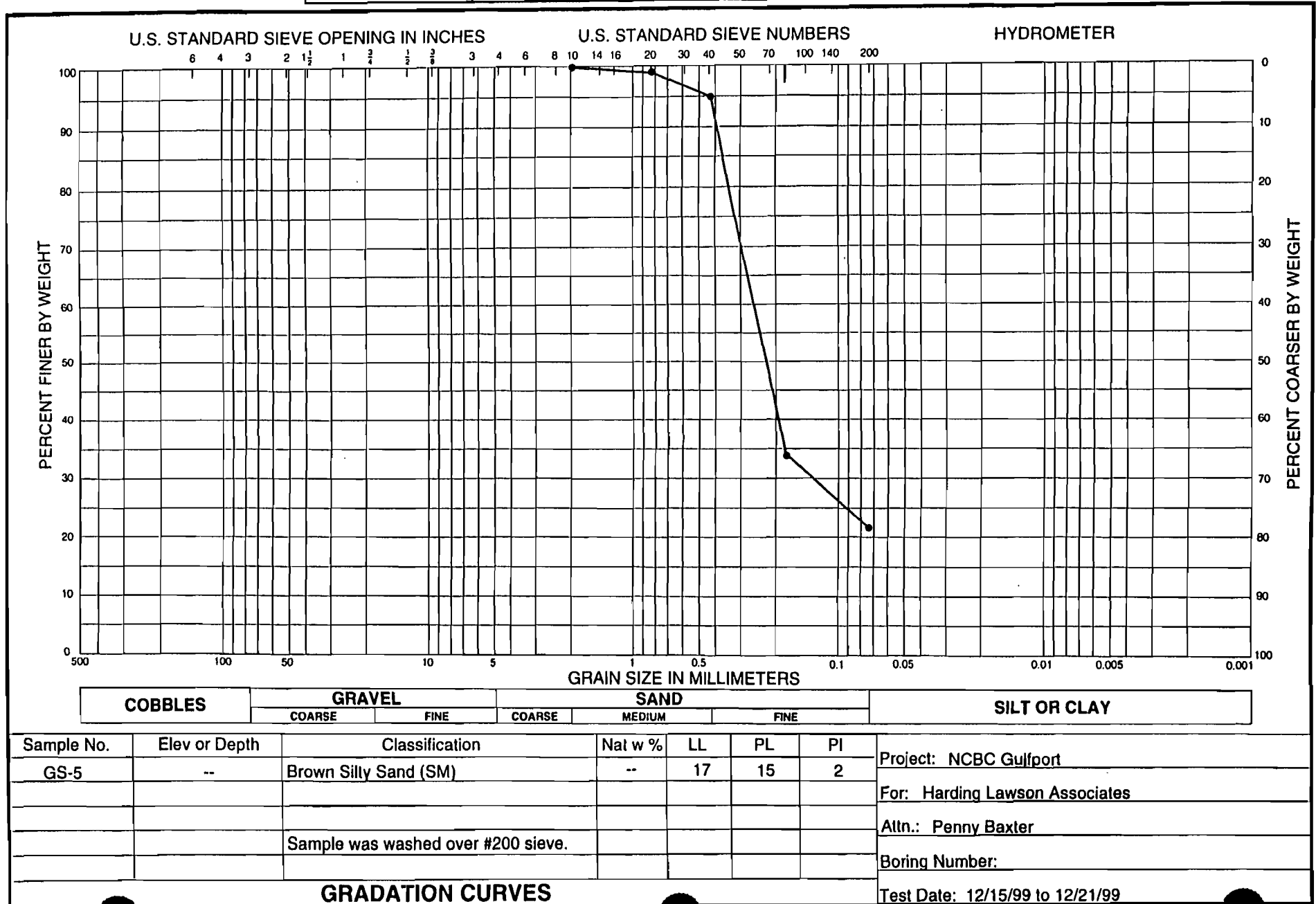
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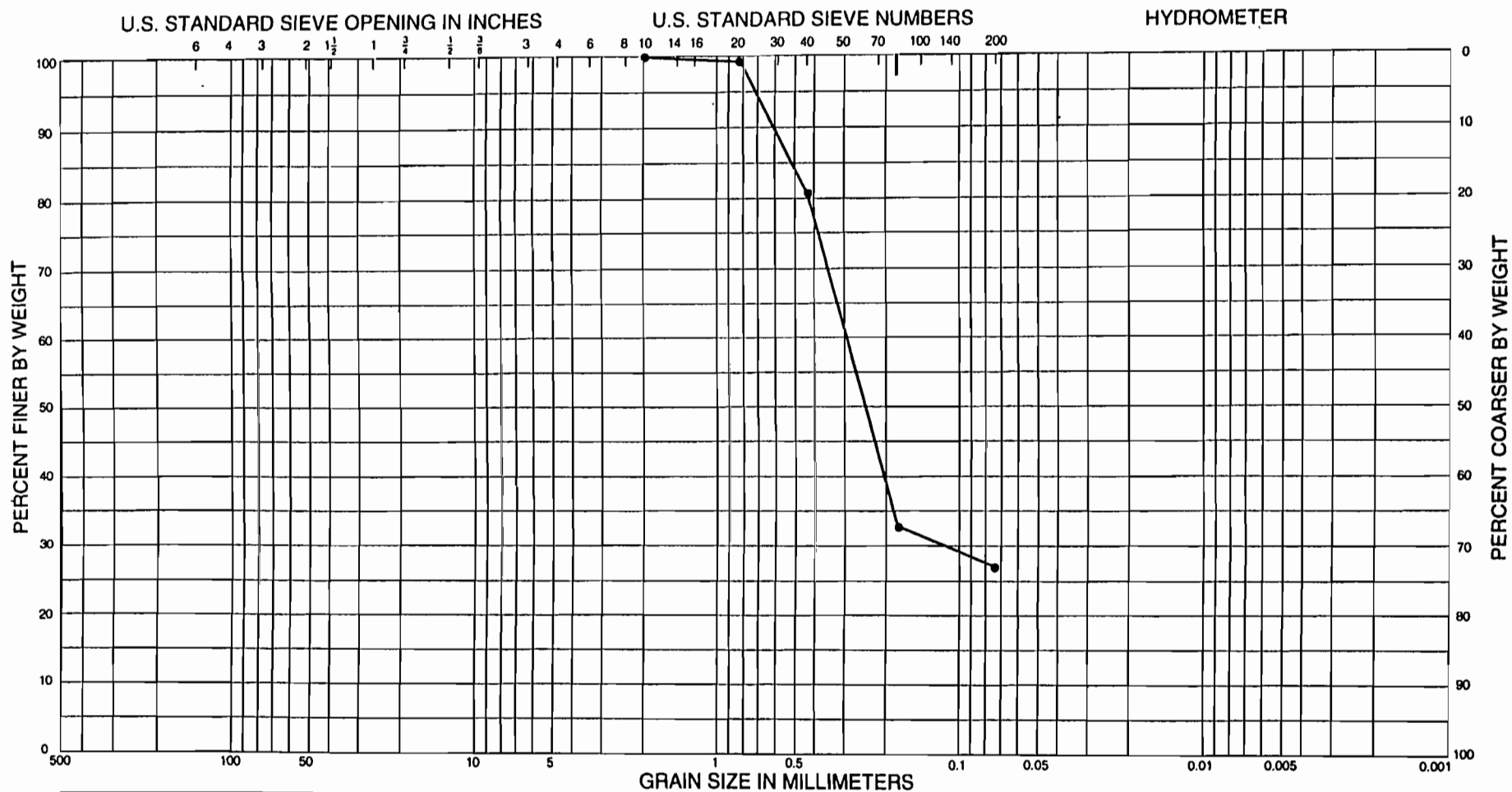


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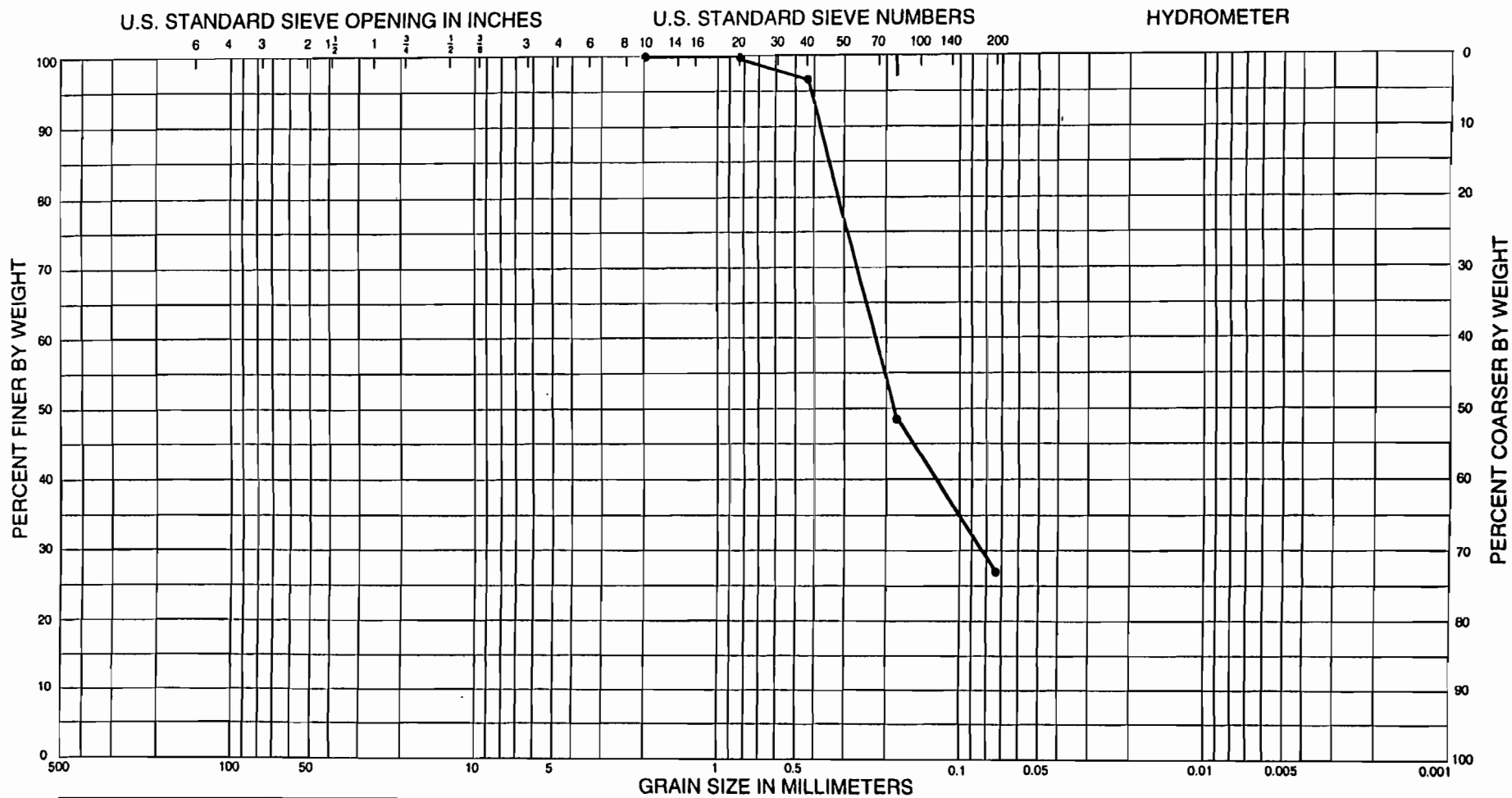


Project: NCBC Gulfport
For: Harding Lawson Associates
Attn.: Penny Baxter
Boring Number:
Test Date: 12/15/99 to 12/21/99

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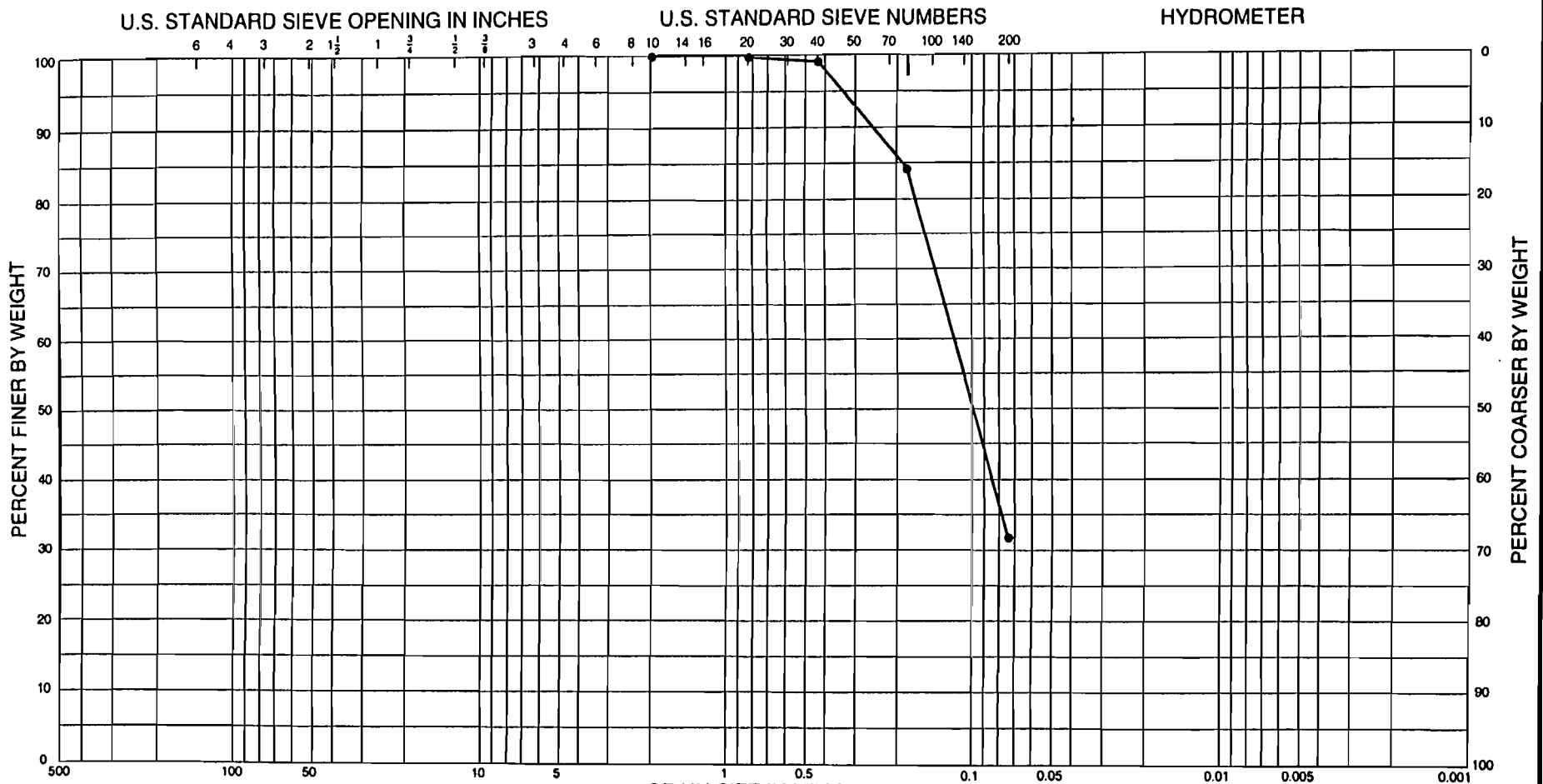
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COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI	Project: NCBC Gulfport For: Harding Lawson Associates Attn.: Penny Baxter Boring Number: Test Date: 12/15/99 to 12/21/99
GS-7	--	Brown Silty Clayey Sand (SC-SM)	--	27	20	7	
		Sample was washed over #200 sieve.					
GRADATION CURVES							

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COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI	
GS-8	--	Brown Grey Silty Clayey Sand (SC-SM)	--	25	20	5	Project: NCBC Gulfport
							For: Harding Lawson Associates
							Attn.: Penny Baxter
		Sample was washed over #200 sieve.					Boring Number:
							Test Date: 12/15/99 to 12/21/99

GRADATION CURVES

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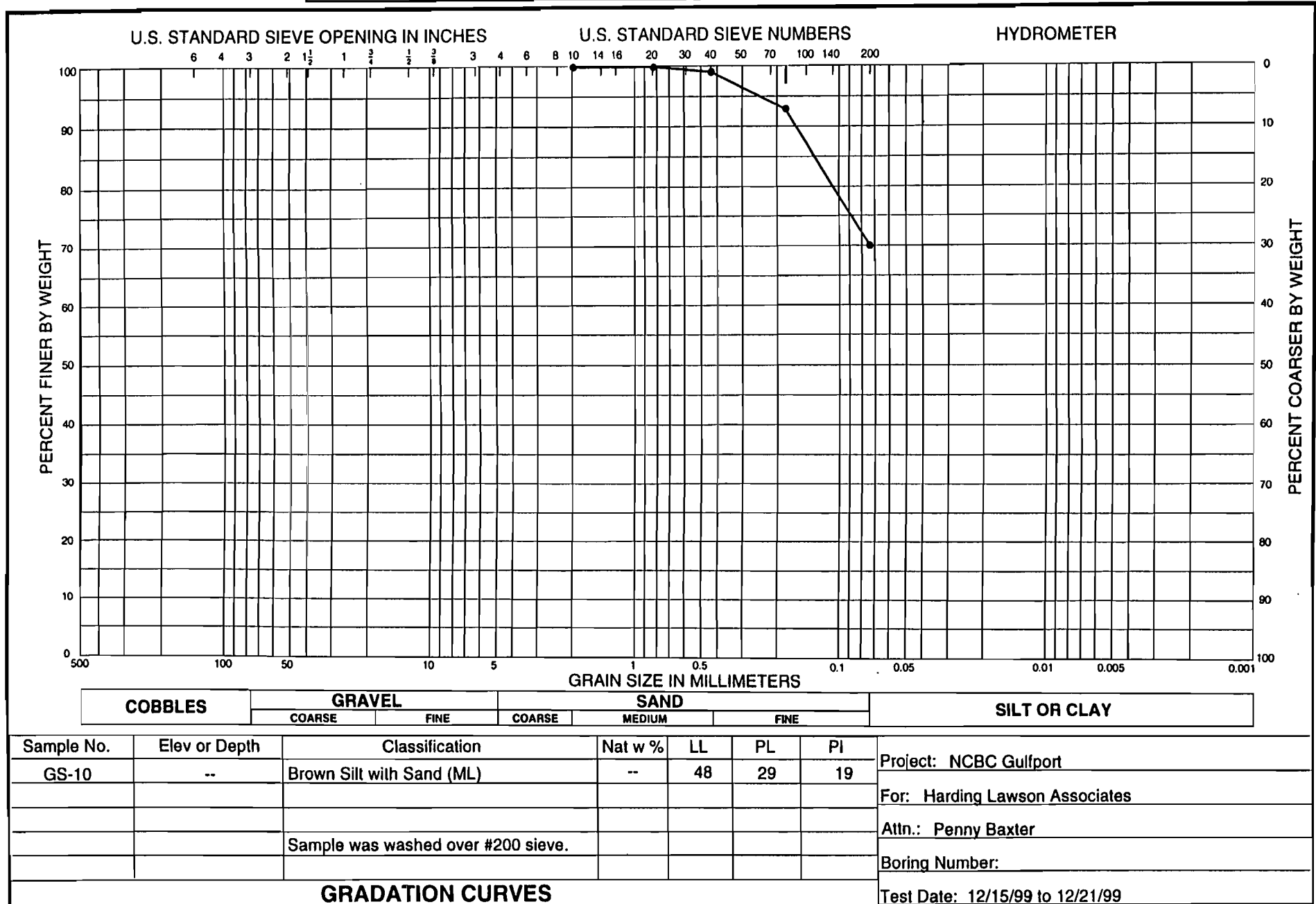


SILT OR CLAY

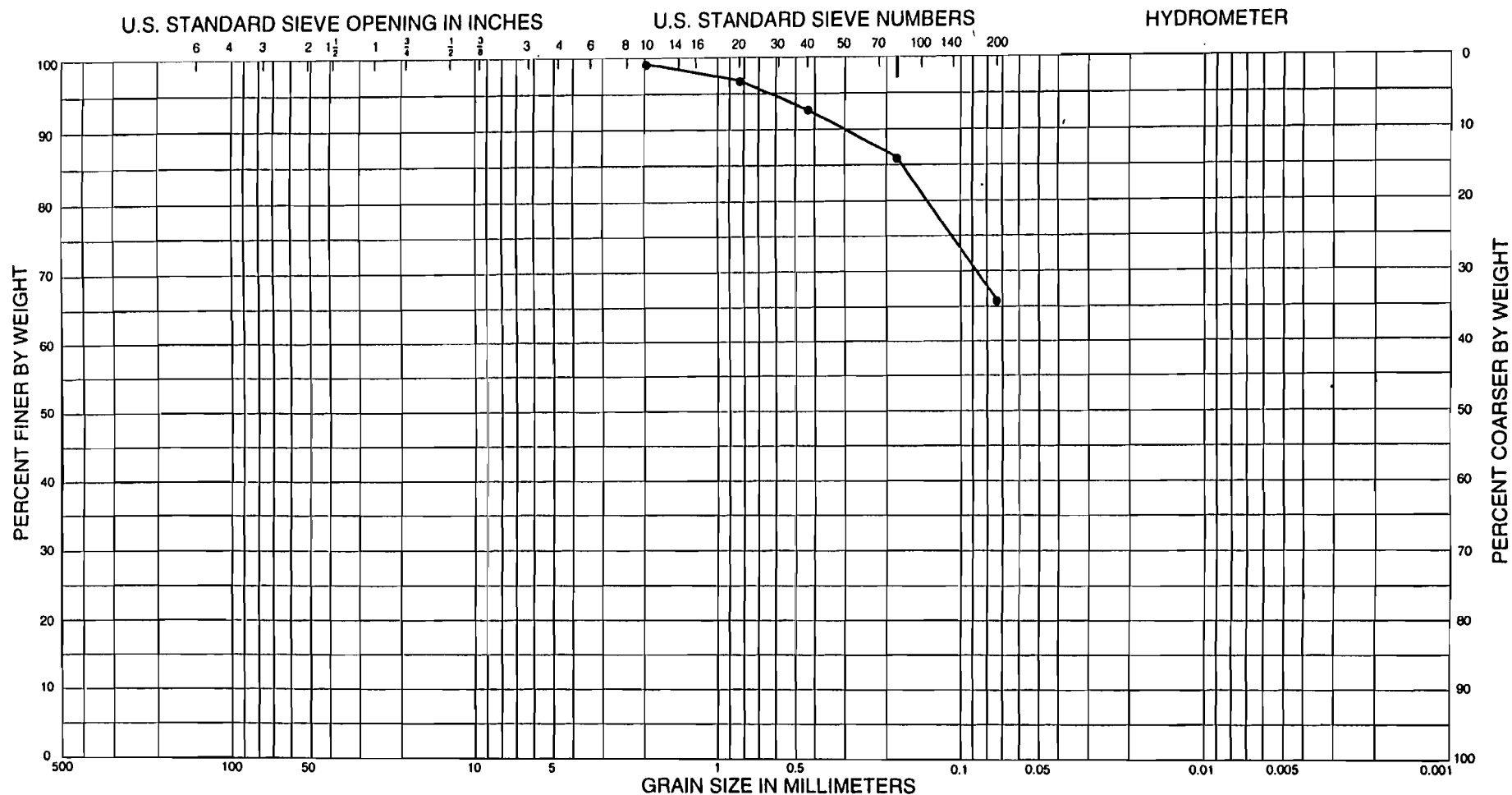
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For:	Harding Lawson Associates
Attn.:	Penny Baxter
Boring Number:	
Test Date:	12/15/99 to 12/21/99

GRADATION CURVES

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COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI	Project: NCBC Gulfport For: Harding Lawson Associates Attn.: Penny Baxter Boring Number: Test Date: 12/15/99 to 12/21/99
GS-11	--	Dark Brown Sandy Elastic Silt (MH)	--	75	38	37	
		Sample was washed over #200 sieve.					

GRADATION CURVES

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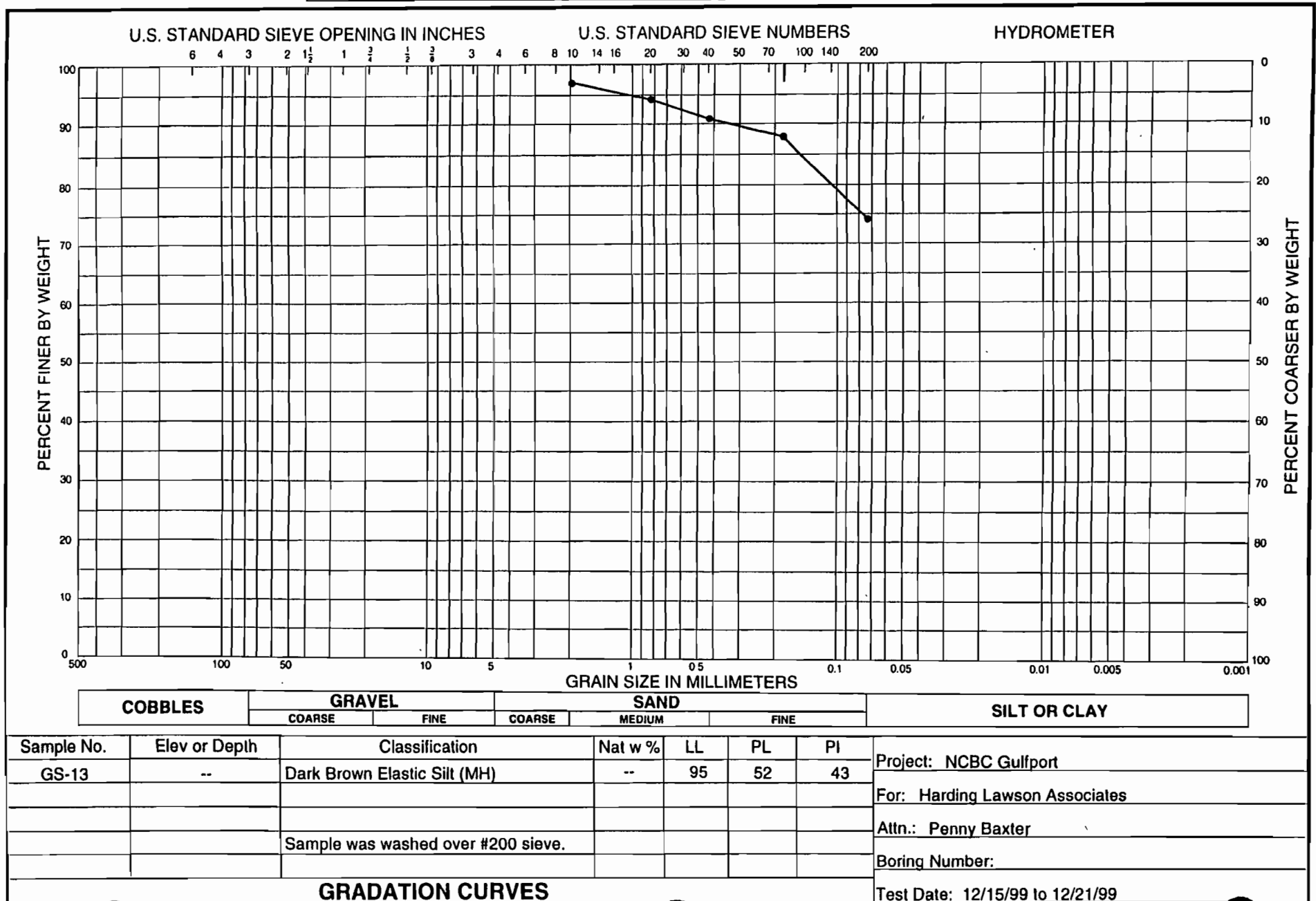
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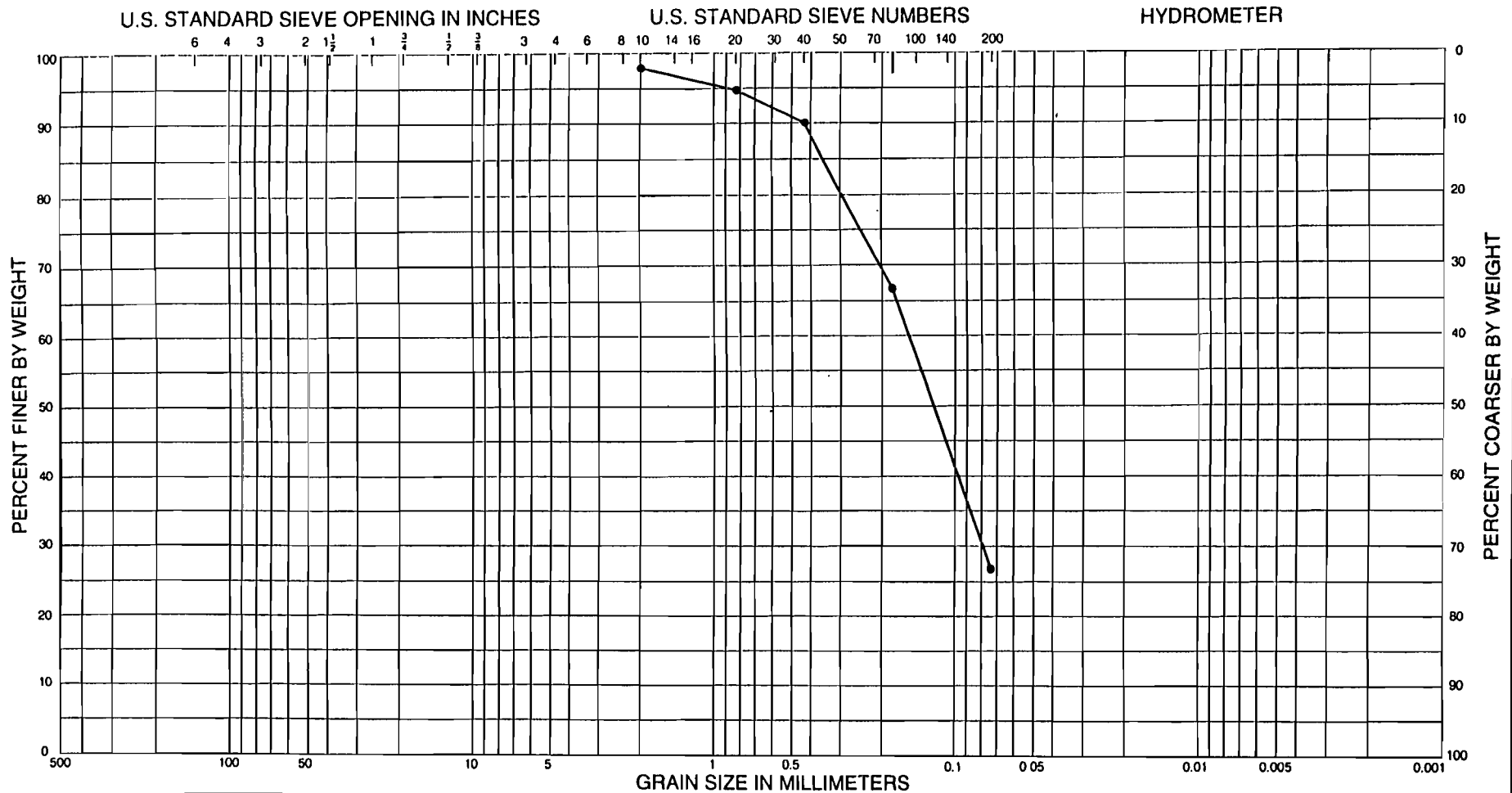
SILT OR CLAY

Project:	NCBC Gulfport
For:	Harding Lawson Associates
Attn.:	Penny Baxter
Boring Number:	
Test Date:	12/15/99 to 12/21/99

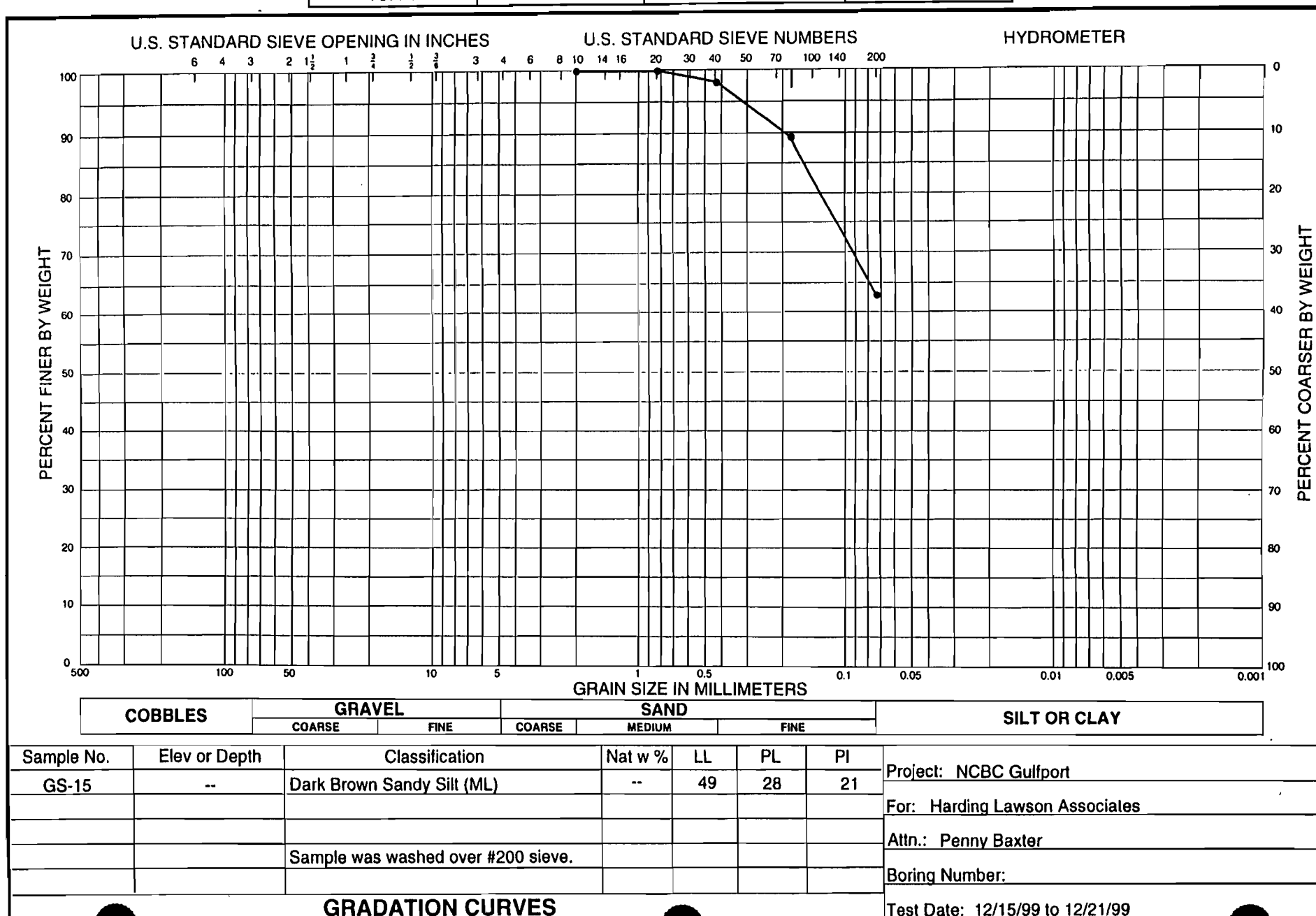
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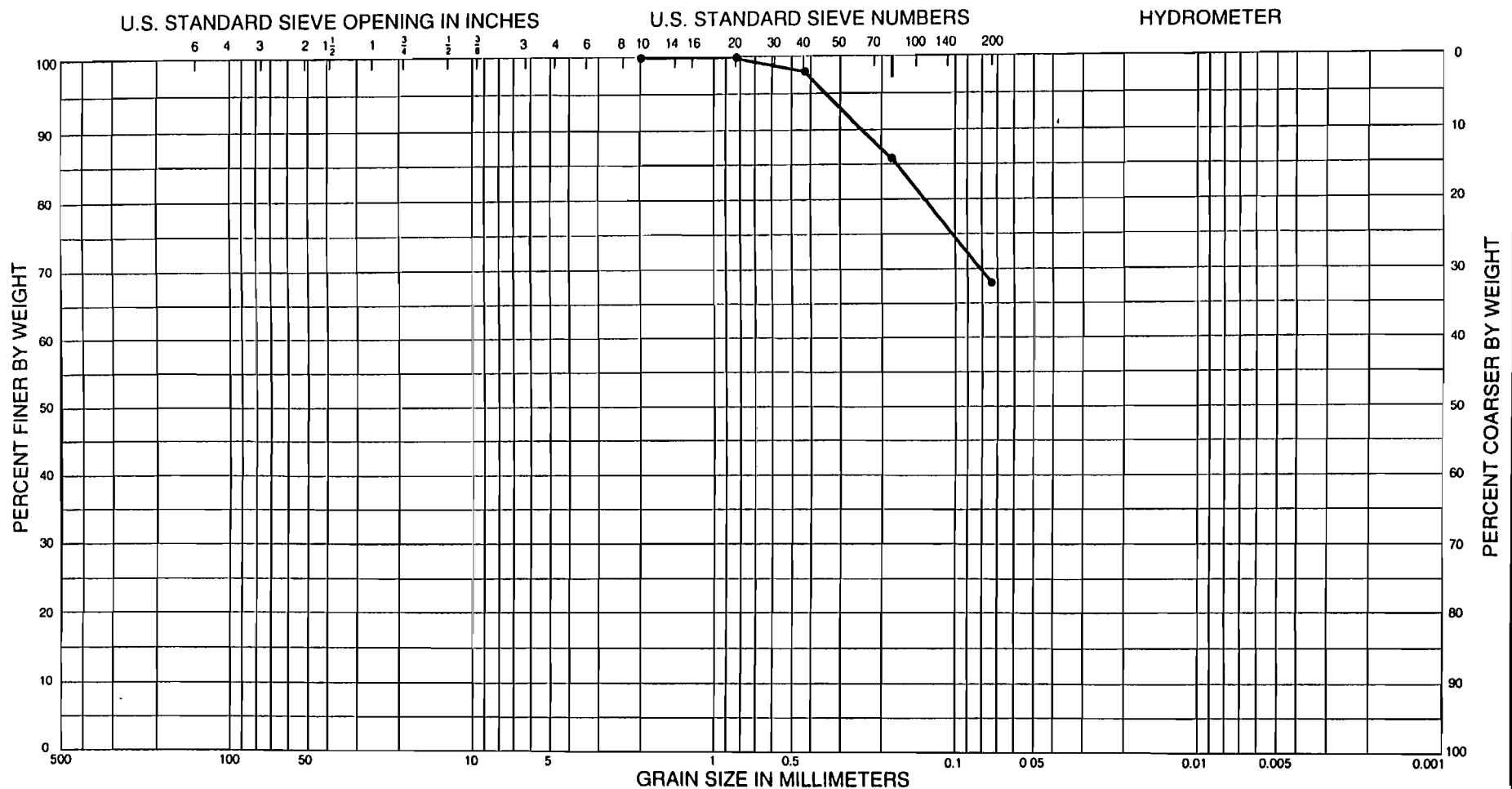
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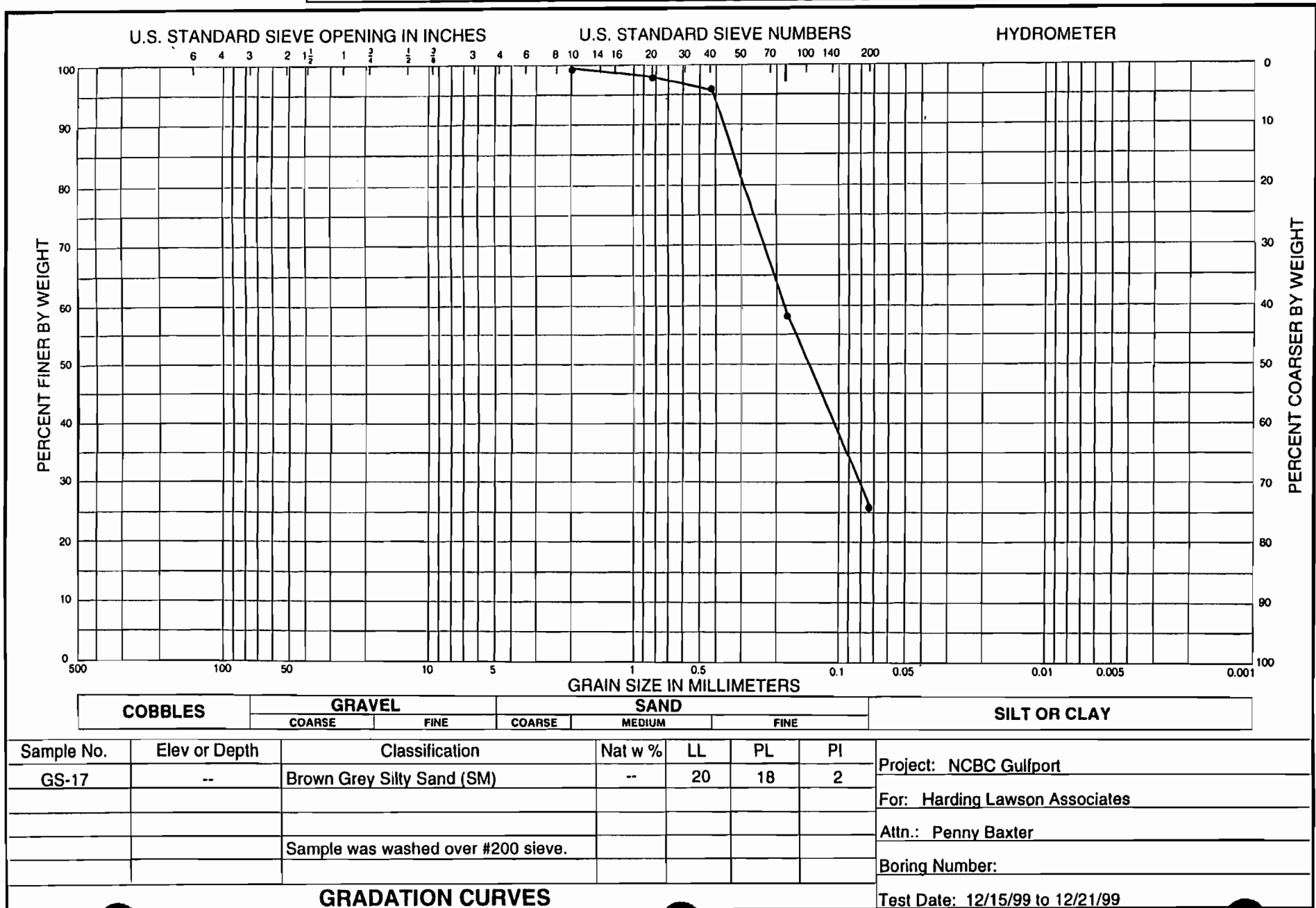


COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

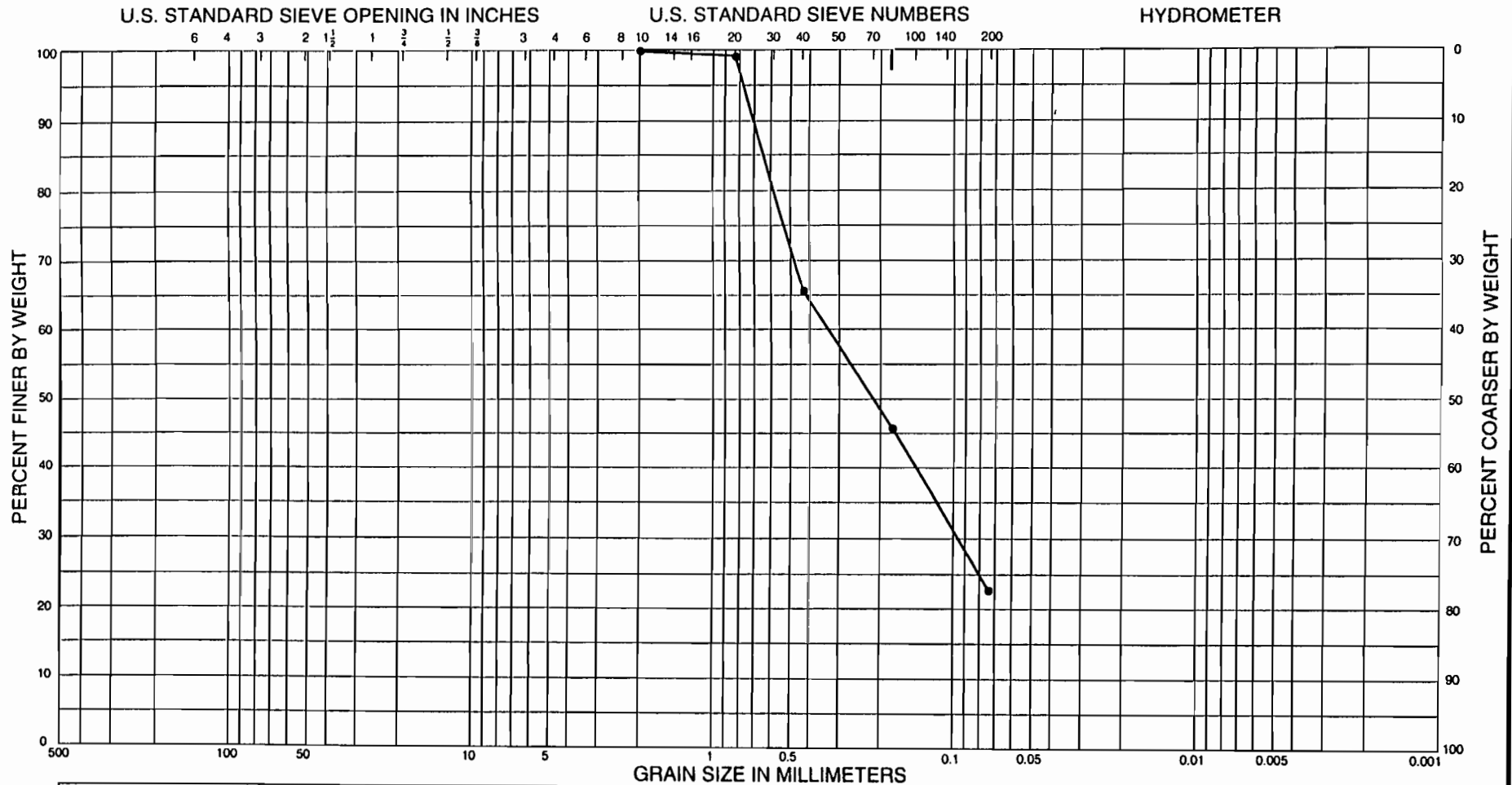
Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI	Project: NCBC Gulfport For: Harding Lawson Associates Attn.: Penny Baxter Boring Number: Test Date: 12/15/99 to 12/21/99
GS-16	--	Dark Brown Sandy Elastic Silt (MH)	--	62	33	29	
		Sample was washed over #200 sieve.					

GRADATION CURVES

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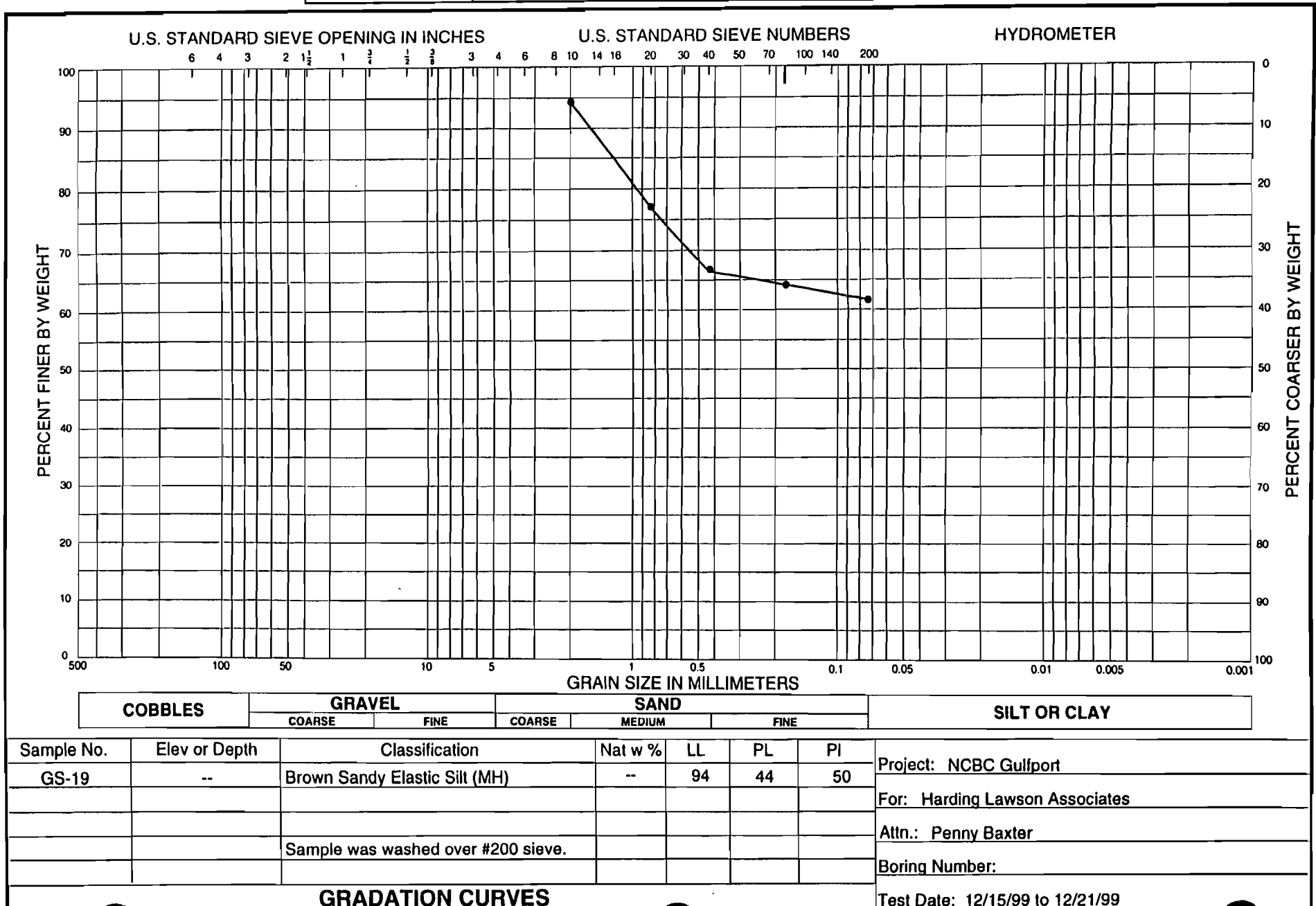


COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

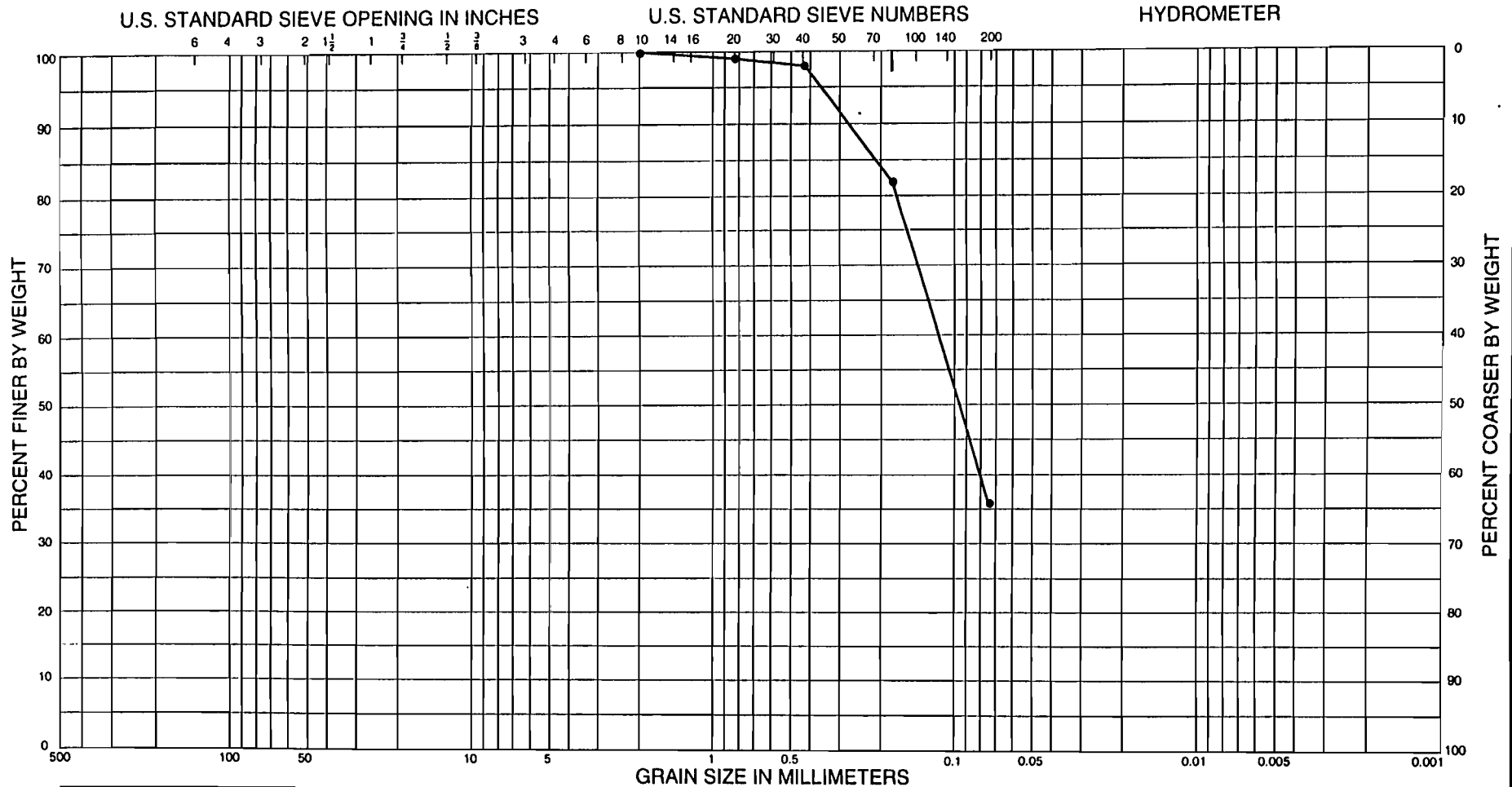
Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI	
GS-18	--	Brown Silty Sand (SM)	--	27	22	5	Project: NCBC Gulfport
							For: Harding Lawson Associates
							Attn.: Penny Baxter
		Sample was washed over #200 sieve.					Boring Number:
							Test Date: 12/15/99 to 12/21/99

GRADATION CURVES

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Chain of Custody Record



QUA-4124

Client Harding Lawson Associates		Project Manager Penny Baxter		Date 12/10/99	Chain Of Custody Number 04089
Address 1400 Centerpoint Blvd #158		Telephone Number (Area Code)/Fax Number 423-531-1922		Lab Number	Page 1 of 2
City Knoxville	State TN	Zip Code 37932	Site Contact Deven Carigan / Barbara Parks		
Project Name NCBC Gulfport			Carrier/Waybill Number		
Contract/Purchase Order/Quote No. PO# 4778					

Sample I.D. No. and Description	Date	Time	Sample Type	Total Volume	Containers		Preservative	Condition on Receipt	Grain Size	Atterberg Limit	CBR	Analysis									
					Type	No.															
GB-1-0-1.5'	12/9/99	1200	Soil	802	802 jar	1	None		X	X											
GB-4	12/9/99	—	Soil	5.5 gal	5.5 gal	1	None		X	X	X										
GB-8-2-4'	12/9/99	—	Soil	802	802 jar	1	None		X	X											
GB-12-4.5-6'	12/9/99	—	Soil	802	802 jar	1	None		X	X											
GB-13-13.5-15'	12/9/99	—	Soil	802	802 jar	1	None		X	X											
GB-8-10-12'	12/9/99	—	Soil	802	802 jar	1	None		X	X											
GB-21-6-8'	12/7/99	—	Soil	802	802 jar	1	None		X	X											
GB-16-8-10'	12/8/99	—	Soil	802	802 jar	1	None		X	X											
ASH-1	12/9/99	—	Soil	802	802 jar	1	None		X	X											
ASH-2	12/9/99	—	Soil	802	802 jar	1	None		X	X											
GS-1	12/8/99	—	Soil	802	802 jar	1	None		X	X											
GS-2	12/8/99	—	Soil	802	802 jar	1	None		X	X											
GS-3	12/9/99	—	Soil	802	802 jar	1	None		X	X											
GS-4	12/9/99	—	Soil	802	802 jar	1	None		X	X											
GS-5	12/9/99	—	Soil	802	802 jar	1	None		X	X											
GS-6	12/9/99	—	Soil	802	802 jar	1	None		X	X											

Special Instructions

Possible Hazard Identification				Sample Disposal			
<input type="checkbox"/> Non-Hazard	<input type="checkbox"/> Flammable	<input type="checkbox"/> Skin Irritant	<input type="checkbox"/> Poison B	<input type="checkbox"/> Unknown	<input type="checkbox"/> Return To Client	<input type="checkbox"/> Disposal By Lab	<input type="checkbox"/> Archive For _____ Months
Turn Around Time Required				QC Level			
<input checked="" type="checkbox"/> Normal <input type="checkbox"/> Rush				<input type="checkbox"/> I. <input type="checkbox"/> II. <input type="checkbox"/> III.			
1. Relinquished By P. Carigan				Date 12-10-99		Time 1115	
2. Relinquished By				Date		Time	
3. Relinquished By				Date		Time	
Project Specific (Specify)				1. Received By		Date	
				2. Received By		Date	
				3. Received By		Date	

Comments

Chain Custody Record



QUA-4124

Client Harding Lawson Associates		Project Manager Penny Baxter		Date 12/10/99	Chain Of Custody Number 04090
Address 1400 Centerpoint Blvd. #158		Telephone Number (Area Code)/Fax Number 423-531-1922		Lab Number	Page 2 of 2
City Knoxville	State IN	Zip Code 37932	Site Contact Daven Carigan / Barbara Sparks		
Project Name WV NCBC Centerpoint			Carrier/Waybill Number		
Contract/Purchase Order/Quote No. PO# 4778					

Sample I.D. No. and Description	Date	Time	Sample Type	Total Volume	Containers		Preservative	Condition on Receipt	Grain Size	Afterberg Limits	Analysis									
					Type	No.														
G5-7	12/9/99	---	Soil	80Z	80Z jar	1	None		X	X										
G5-8	12/8/99	---	Soil	80Z	80Z jar	1	None		X	X										
G5-9	12/8/99	---	Soil	80Z	80Z jar	1	None		X	X										
G5-10	12/8/99	---	Soil	80Z	80Z jar	1	None		X	X										
G5-11	12/8/99	---	Soil	80Z	80Z jar	1	None		X	X										
G5-12	12/8/99	---	Soil	80Z	80Z jar	1	None		X	X										
G5-13	12/8/99	---	Soil	80Z	80Z jar	1	None		X	X										
G5-14	12/8/99	---	Soil	80Z	80Z jar	1	None		X	X										
G5-15	12/9/99	---	Soil	80Z	80Z jar	1	None		X	X										
G5-16	12/9/99	---	Soil	80Z	80Z jar	1	None		X	X										
G5-17	12/9/99	---	Soil	80Z	80Z jar	1	None		X	X										
G5-18	12/9/99	---	Soil	80Z	80Z jar	1	None		X	X										
G5-19	12/9/99	---	Soil	80Z	80Z jar	1	None		X	X										
G5-20	12/9/99	---	Soil	80Z	80Z jar	1	None		X	X										

Special Instructions

Possible Hazard Identification		Sample Disposal	
<input type="checkbox"/> Non-Hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown	<input type="checkbox"/> Return To Client <input type="checkbox"/> Disposal By Lab <input type="checkbox"/> Archive For _____ Months		
Turn Around Time Required	QC Level	Project Specific (Specify)	
<input checked="" type="checkbox"/> Normal <input type="checkbox"/> Rush	<input type="checkbox"/> I. <input type="checkbox"/> II. <input type="checkbox"/> III.		
1. Relinquished By	Date	Time	1. Received By
D. Carigan	12-10-99	1115	
2. Relinquished By	Date	Time	2. Received By
3. Relinquished By	Date	Time	3. Received By

Comments

DISTRIBUTION: WHITE - Stays with Sample; CANARY - Returned to Client with Report; PINK - Field Copy



APPENDIX C

RISK-BASED REMEDIATION LEVEL INFORMATION

Table C-1
Basic Risk-Based Remediation Equation and Parameters

Remediation Planning Document
 Naval Construction Battalion Center
 Gulfport, Mississippi

$$\text{Remediation Goal [mg/kg]} = \frac{\text{TR} \cdot \text{BW} \cdot \text{AT}}{\left[(\text{SF}_0 \cdot \text{IR} \cdot \text{FI} \cdot \text{CF} \cdot \text{EF} \cdot \text{ED}) + \left(\text{SF}_i \cdot \left(\frac{1}{\text{PEF}} \right) \cdot \text{Inh} \cdot \text{EF} \cdot \text{ET} \cdot \text{ED} \right) + (\text{SF}_d \cdot \text{SA} \cdot \text{AF} \cdot \text{ABS} \cdot \text{CF} \cdot \text{EV} \cdot \text{ED}) \right]}$$

Basic Cleanup Equation Input Values:

Abbreviation	Value	Description
TR	1x10 ⁻⁶	Target Risk of 1x10 ⁻⁶
Cleanup Goal	Calculated	Cleanup Goal (parts per million [ppm])

Skin Surface Area:

Abbreviation	Value	Description
SAw	5,750	Surface Area – site worker (square centimeter [cm ²])
SAex	5,750	Surface Area - excavation worker (cm ²)
SAocc	2,300	Surface Area - occupational worker (cm ²)
SAad	5,750	Surface Area - adult (cm ²)
SAtrad	5,750	Surface Area - adult trespasser (cm ²)
SAFc	766.7	Surface Area Factor - child (centimeter squared times years per kilogram [cm ² *yr/kg])
SAFtrc	1,136.3	'Surface Area Factor – adolescent trespasser (cm ² *yr/kg)

For the child resident and child trespasser, SA (surface area) = Sum (SAx*BWx)/EFx

where: SAx = age specific surface area

BWx = age specific body weight

EFx = exposure frequency

Conversion Factors:

CF	1 x 10 ⁻⁶	Conversion Factor (kilograms per milligram [kg/mg])
----	----------------------	---

Particulate Emission Factors:

PEF	4.97 x 10 ⁷	Particulate Emission Factor (cubic meter per kilogram [m ³ /kg])
-----	------------------------	---

Absorption Factor (unitless):

Abbreviation	Value	Description
ABS	0.01	Absorption factor (unitless)

Skin Adherence Factors:

Abbreviation	Value	Description (milligrams per square centimeter - event [mg/cm ² -event])
Afw	0.5	Soil to Skin Adherence Factor - worker (mg/cm ² -event)
Afr	1	Soil to Skin Adherence Factor - resident (mg/cm ² -event)
Aftr	1	Soil to Skin Adherence Factor - trespasser (mg/cm ² -event)

Soil Ingestion Rate:

Abbreviation	Value	Description (milligrams per day [mg/day])
IRw	50	Ingestion Rate – site worker (mg/day)
IRex	480	Ingestion Rate – excavation worker (mg/day)
IRocc	50	Ingestion Rate – occupation worker (mg/day)
IRad	100	Ingestion Rate – adult resident (mg/day)
IRc	200	Ingestion Rate – child resident (mg/day)
IRtrad	50	Ingestion Rate – adult trespasser (mg/day)
IRtrc	100	Ingestion Rate – adolescent trespasser (mg/day)
FI	1	Fraction Ingestion (unitless)

See notes at end of table.

Table C-1 (Continued)
Basic Risk-Based Remediation Equation and Parameters

Remediation Planning Document
Naval Construction Battalion Center
Gulfport, Mississippi

Sediment Ingestion Rate:

<u>Abbreviation</u>	<u>Value</u>	<u>Description</u> (milligrams per day [mg/day])
IRw	50	Ingestion Rate – site worker (mg/day)
IRex	480	Ingestion Rate – excavation worker (mg/day)
IRocc	125	Ingestion Rate – occupation worker (mg/day)
IRad	100	Ingestion Rate – adult resident (mg/day)
IRc	200	Ingestion Rate – child resident (mg/day)
IRtrad	50	Ingestion Rate – adult trespasser (mg/day)
IRtrc	100	Ingestion Rate – adolescent trespasser (mg/day)
FI	1	Fraction Ingestion (unitless)

Inhalation Rate:

<u>Abbreviation</u>	<u>Value</u>	<u>Description</u> (cubic meters per hour [m ³ /hr])
InhRw	0.833	Inhalation Rate – site worker (m ³ /hr)
InhRex	2.5	Inhalation Rate – excavation worker (m ³ /hr)
InhRocc	1	Inhalation Rate – occupational worker (m ³ /hr)
InhRad	0.833	Inhalation Rate – adult resident (m ³ /hour)
InhRc	0.833	Inhalation Rate – child resident (m ³ /hour)
InhRtrad	0.833	Inhalation Rate – adult trespasser (m ³ /hour)
InhRtrc	0.833	Inhalation Rate – child trespasser (m ³ /hour)

Exposure Time:

<u>Abbreviation</u>	<u>Value</u>	<u>Description</u> (hours per day [hr/day])
ETw	8	Exposure Time - site worker (hr/day)
ETex	8	Exposure Time - excavation worker (hr/day)
ETocc	8	Exposure Time - occupational worker (hr/day)
ETag	16	Exposure Time - aggregate resident (hr/day)
ETad	16	Exposure Time - adult resident (hr/day)
ETc	16	Exposure Time - child resident (hr/day)
ETtrad	1	Exposure Time - adult trespasser (hr/day)
ETtrc	1	Exposure Time - child trespasser (hr/day)

Exposure Frequencies (Surface soil):

<u>Abbreviation</u>	<u>Value</u>	<u>Description</u> (days per year [day/yr])
EFw	24	Exposure Frequency – site worker (day/yr)
EFex	30	Exposure Frequency – excavation worker (day/yr)
EFocc	250	Exposure Frequency – occupation worker (day/yr)
EFad	350	Exposure Frequency – adult resident (day/yr)
EFc	350	Exposure Frequency – child resident (day/yr)
EFtrad	24	Exposure Frequency – adult trespasser (day/yr)
EFtrc	30	Exposure Frequency – adolescent trespasser (day/yr)

Exposure Frequencies (Sediment):

<u>Abbreviation</u>	<u>Value</u>	<u>Description</u> (day per year [day/yr])
EFw	12	Exposure Frequency – site worker (day/yr)
EFex	30	Exposure Frequency – excavation worker (day/yr)
EFocc	30	Exposure Frequency – occupation worker (day/yr)
EFad	30	Exposure Frequency – adult resident (day/yr)
EFc	30	Exposure Frequency – child resident (day/yr)
EFtrad	24	Exposure Frequency – adult trespasser (day/yr)
EFtrc	30	Exposure Frequency – adolescent trespasser (day/yr)

See notes at end of table.

Table C-1 (Continued)
Basic Risk-Based Remediation Equation and Parameters

Remediation Planning Document
Naval Construction Battalion Center
Gulfport, Mississippi

Event Frequencies (Surface soil):

<u>Abbreviation</u>	<u>Value</u>	<u>Description</u> (events per year [event/yr])
EVw	24	Event Frequency – site worker (event/yr)
EVex	30	Event Frequency – excavation worker (event/yr)
EVocc	250	Event Frequency – occupation worker (event/yr)
EVad	350	Event Frequency – adult resident (event/yr)
EVc	350	Event Frequency – child resident (event/yr)
EVrad	24	Event Frequency – adult trespasser (event/yr)
EVtrc	30	Event Frequency – adolescent trespasser (event/yr)

Event Frequencies (Sediment):

<u>Abbreviation</u>	<u>Value</u>	<u>Description</u> (events per year [event/yr])
EVw	12	Event Frequency – site worker (event/yr)
EVex	30	Event Frequency – excavation worker (event/yr)
EVocc	30	Event Frequency – occupation worker (event/yr)
EVad	30	Event Frequency – adult resident (event/yr)
EVc	30	Event Frequency – child resident (event/yr)
EVtrad	24	Event Frequency – adult trespasser (event/yr)
EVtrc	30	Event Frequency – adolescent trespasser (event/yr)

Exposure Duration:

<u>Abbreviation</u>	<u>Value</u>	<u>Description</u>
EDw	25	Exposure Duration – site worker (years)
EDex	1	Exposure Duration – excavation worker (years)
EDocc	25	Exposure Duration – occupation worker (years)
EDad	24	Exposure Duration – adult resident (years)
EDc	6	Exposure Duration – child resident (years)
EDtrad	19	Exposure Duration – adult trespasser (years)
EDtrc	11	Exposure Duration – adolescent trespasser (years)

Body Weights:

<u>Abbreviation</u>	<u>Value</u>	<u>Description</u> (kilograms [kg])
BWw	70	Body Weight – all workers (kg)
BWad	70	Body Weight – adult resident (kg)
BWc	15	Body Weight – child resident (kg)
BWtrad	70	Body Weight – adult trespasser (kg)
BWtrc	40	Body Weight – adolescent trespasser (kg)

Averaging Time:

<u>Abbreviation</u>	<u>Value</u>	<u>Description</u>
ATc	25,550	Averaging Time – Cancer (days)

Slop Factors:

<u>Abbreviation</u>	<u>Value</u>	<u>Description</u> ((milligrams per kilogram - day) ⁻¹ [(mg/kg-day) ⁻¹])
SFo	1.5x10 ⁵	Oral Cancer Slope Factor – (mg/kg-day) ⁻¹
SFi	1.5x10 ⁵	Inhalation Cancer Slope Factor – (mg/kg-day) ⁻¹
SFd	1.5x10 ⁵	Dermal Cancer Slope Factor – (mg/kg-day) ⁻¹

Notes: Calculated remediation goals may differ based on rounding errors.

The sediment ingestion rate for the occupational worker was conservatively set at 2.5 times the surface soil ingestion rate for the occupational worker.

Table C-2
USEPA Dioxin and Furan Toxic Equivalency Factors

Remediation Planning Document
Naval Construction Battalion Center
Gulfport, Mississippi

Congener	Toxic Equivalency Factor
Dioxins	
2,3,7,8-Tetrachloro-p-dibenzodioxins (TCDDs)	1
Other TCDDs	0
2,3,7,8-Pentachloro-p-dibenzodioxins (PeCDDs)	0.5
Other PeCDDs	0
2,3,4,7,8-Hexachloro-p-dibenzodioxins (HxCDDs)	0.1
Other HxCDDs	0
1,2,3,4,6,7,8-Heptachloro-p-dibenzodioxins (HpCDDs)	0.01
Other HpCDDs	0
Octachloro-p-dibenzodioxins (OCDDs)	0.001
Furans	
2,3,7,8-Tetrachloro-p-dibenzofurans (TCDFs)	0.1
Other TCDFs	0
2,3,7,8-Pentachloro-p-dibenzofurans (PeCDFs)	0.05
Other PeCDFs	0
2,3,7,8-Hexachloro-p-dibenzofurans (HxCDFs)	0.1
Other HxCDFs	0
2,3,7,8-Heptachloro-p-dibenzofurans (HpCDFs)	0.01
Other HpCDFs	0
Octachloro-p-dibenzofurans (OCDFs)	0.001
Source: <i>Interim Procedures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins (CDDs and CDFs) and 1989 update</i> (USEPA, 1989).	
Note: USEPA = U.S. Environmental Protection Agency.	

APPENDIX D
REGULATORY INFORMATION AND GUIDANCE

CITY OF GULFPORT TREE PROTECTION ORDINANCE



Urban Development Planning Division
24th Avenue, Room 206
Gulfport, MS 39501
(601) 856-5710

TREE PROTECTION ORDINANCE

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There came on next for consideration the following Ordinance:

ORDINANCE NO. 1841

AN ORDINANCE REGULATING CUTTING AND REMOVAL OF TREES IN THE CITY OF GULFPORT, MISSISSIPPI, PROVIDING FOR A PERMIT FOR REMOVAL, PROVIDING FOR PENALTIES FOR VIOLATION OF ANY PROVISIONS OF THIS ORDINANCE, AND FOR RELATED PURPOSES.

WHEREAS, the trees within the City of Gulfport, Mississippi, constitute an economic and aesthetic asset that is irreplaceable and constitute the very essence of this city's character; and

WHEREAS, the presence of trees in the City of Gulfport, Mississippi, in addition to the economic and aesthetic value, promote soil conservation, reduce air pollution and noise, prevent erosion, provide habitat and food for wildlife and birds, and provide visual screening; and

WHEREAS, the removal of said trees impair the benefits to existing property owners in the surrounding area, and impair economic stability and decrease the value of improved and unimproved real property, causes increased surface drainage, flash floods, ultimately causing increased municipal costs; and

WHEREAS, the City Council of the City of Gulfport is of the opinion that it would be in the public interest and welfare to enact reasonable regulations controlling the removal of certain protected trees so as to retain as many trees as possible consistent with economic enjoyment of private property; and

WHEREAS, the City of Gulfport finds that it is in the public interest and welfare to require the replacement of trees removed during the process of development for the environmental benefit and enjoyment of all; and

WHEREAS, the intent of this ordinance is to encourage the protection of certain trees which are common to this geographical area, and which the City of Gulfport stands to lose unless protective measures are taken. The intent is not punitive nor to cause hardship on any individual, private or public company who uses every care and diligence to protect trees within the City of Gulfport, Mississippi; and

WHEREAS, The City of Gulfport finds that it is in the public interest and welfare that this ordinance be enacted.

NOW, THEREFORE, BE IT ORDAINED BY THE COUNCIL OF THE CITY OF GULFPORT, MISSISSIPPI, AS FOLLOWS:

SECTION 1. That Chapter 8, Article I, Sections 8.1 through 8.5 of the Code of Ordinances of the City of Gulfport shall be hereby repealed and deleted, and amended to read as follows:

Sec. 8-1 Purpose and Intent.

The purpose of this article is to regulate, control and promote the planting of trees, to encourage the protection of existing trees in the streets and public grounds within the city, to regulate the preservation, replacement and indiscriminate removal of trees on private property, on both unimproved lands and on land which have heretofore been improved to any extent whatsoever, and to establish procedures and practices for fulfilling these purposes.

The intent of this ordinance is to encourage the protection of existing trees and to promote the planting of additional trees in order to facilitate control of soil conservation, air pollution and noise, and to enhance the beauty, health and safety of the environment for the City of Gulfport.

Sec. 8-2. Creation of a Tree Protection Advisor. (Amended No.1841 on March 27, 1990)

A Tree Protection Advisor is hereby created and shall direct, regulate, and control the care of and necessary removal of all trees existing now and hereafter in the City of Gulfport.

The Tree Protection Advisor shall be an arborist or a horticulturist. The arborist/horticulturist shall take active steps to process and render decisions granting or denying applications for permits under this article. Any decisions of the Tree Protection Advisor, as authorized herein, shall be final, unless an appeal is submitted to the Gulfport City Planning Commission.

Sec. 8-2 A. Creation of Tree Advisory Board.

A Tree Advisory Board is hereby created and established. The Board shall consist of three (3) members each appointed for a term of four (4) years by the Mayor. Of the members first appointed one (1) shall be for a term of two (2) years, one (1) for a term of three (3) years and one (1) for a term of four (4) years. Vacancies shall be filled by the Mayor for the unexpired term of the member affected.

- (a) Proceedings. The Tree Advisory Board shall adopt rules for the conduct of its affairs and in keeping with the provisions of this ordinance. Meetings shall be held four (4) times during the calendar year and at such other times as the Board may determine. All meetings of the Board shall be open to the public.
- (b) Purpose. The Tree Advisory Board shall serve an advisory function to the Mayor, City Council, and Planning Commission in the areas of tree preservation, tree promotion and related activities.

- (c) Responsibilities. The responsibilities of the Tree Advisory Board are, but are not limited to, the following:

- (1) Development of and periodic revision to a comprehensive community tree management program for the care of trees on public property.
- (2) Development of a self-financed annual community work plan for trees on public property.
- (3) Development of and periodic revision to a comprehensive inventory of protected trees on public property including species, location and condition of each tree.
- (4) Draft an Arbor Day proclamation for the Mayor to proclaim the, 1st week of April as "Arbor Week."
- (5) Develop and administer citizen support for the preservation and promotion of trees and related activities.
- (6) Develop recommendations to regulate, control and promote the planting of trees and to encourage the protection of existing trees in the streets and public within the City of Gulfport.
- (7) Develop of annual report stating an objective analysis of the present state of the urban forest with recommendation for future management.

Sec. 8-3. Definitions.

(a) Tree (Protected). Any woody, perennial, hardwood plant that is either a live oak (*quercus virginiana*), southern magnolia (*magnolia grandiflora*), sweetbay (*magnolia virginiana*), sweetgum (*liquidambar styraciflua*), or a red maple (*acer rubrum*) that has a single or multiple trunk with a total caliper trunk of eight (8) inches or a circumference of twenty-five (25) inches or more. Also, any tree which has been registered with Societe' des Arbes.

(b) Caliper. The diameter of any tree trunk thirty-six (36) inches above ground level.

(c) Residual Density. The number of natural trees growing on an existing lot or site that is expressed as the actual number of trees per square feet of area.

(d) Replacement Tree. A tree of the same species as that of the protected tree having a minimum one and one-half (1-1/2) inch caliper nursery stock with a minimum height of seven (7) feet after planting.

(e) Drip Line. A vertical line running through the outermost portion of a tree crown extending to the ground.

(f) Destroy. Any intentional or negligent act which causes a tree to decline and die, including but not limited to, such damage inflicted upon the root system of a tree by the application of toxic substances, the operation of heavy machinery, the change of natural grade by excavation or filling the covered area or around the trunks of a tree, trenching, paving with concrete, asphalt or other impervious materials, and damages from injury or from fire inflicted on trees which result in or permit pest infestation. Cutting, grilling, injecting, bulldozing, and excessive pruning that result in the death of a tree is also considered destruction.

(g) Protective Barrier. A physical structure limiting access to a protected tree, composed of wood or other suitable materials which assures compliance with the intent of this article.

(h) Tree Removal. The displacement, removal, relocation, alteration or effective removal as a result of damaging or destroying any protected tree.

Sec. 8-4. Application of the Provisions.

The provisions of this ordinance shall apply to protected trees that are located on any real property that is located or lying within a district that has been designated on the Gulfport Comprehensive Zoning District Map as multi-family residential district, provided said development exceeds ten (10) attached units per acre, commercial districts and industrial districts.

Sec. 8-5 Required Permits.

(a) Tree Removal. It shall be unlawful for any person, without first obtaining a permit to do so as herein provided, to remove, cause to be removed, relocated, or substantially alter or to effectively remove as a result of damaging or destroying any protected tree. It shall be unlawful for any licensed tree surgeon, service company, or general contractor to remove, cause to be removed, relocate, or substantially alter or to effectively remove as a result of damaging or destroying any tree covered by the terms and provisions of this ordinance without first having in its possession a proper permit authorizing the removal of said tree. Upon the second violation of the terms and provisions of

this ordinance by any licensed tree surgeon, service company, or general contractor, the Mayor and City Council shall, after investigation by the Tree Protection Advisor and upon subsequent recommendation to them, revoke for a period of six (6) months the city privilege license of said tree surgeon, service company, or general contractor.

(b) Site Plans for Development or Redevelopment. A site plan for the development or redevelopment of any tract of land located in the City of Gulfport shall be submitted to the City along with the application for a building permit prior to the removal of any tree as herein defined. No building permit shall be issued until the tree site plan has been reviewed and approved in writing by the Tree Protection Advisor and a permit as provided, is issued or denied within seven (7) working days of submittal. Reasons for denial shall also be reported to the applicant in writing. If the applicant is not notified of approval or disapproval within seven (7) working days, such plans shall be considered approved and such permit shall be considered issued by the Tree Protection Advisor through the Building Official. The tree site plan, in quadruplicate, (4), must show in addition to the usual requirements, the following information at a scale sufficient to enable the determination of matters required under these regulations:

- (1) The shape and dimensions of the lot or parcel, together with the existing and proposed locations of structures and improvements, if any.
- (2) Location and dimensions of all protected trees identified by common or botanical name. Trees proposed to remain, to be relocated or to be removed shall be so identified. Groups of trees in close proximity, three (3) foot spacing or closer, may be designated as a "clump" of trees, and a predominant species, estimated number, and average size listed.
- (3) A statement showing how trees not proposed for removal are to be protected during land clearing and construction, i.e., a statement as to proposed Protective Barriers as defined in Section 8-3.
- (4) Statement as to grade changes proposed for the lot or parcel and how such changes will effect these regulations.
- (5) Any proposed tree replacement program.
- (6) The Tree Protection Advisor may require the applicant to furnished additional information as he deems necessary and appropriate to properly analyze the application.

The function of the Tree Protection Advisor in the review of the site plans will be to assure that protected trees are preserved and retained within the City. A permit from the Tree Protection Advisor is required for any work on or affecting trees covered by the provisions of this ordinance. The Tree Protection Advisor shall specify the work to be done, and may inspect the work in progress and make a final inspection upon completion of the work as necessary. The Building Official shall have concurrent authority to enforce the regulations of this ordinance, in the event the Tree Protection Advisor is unable to inspect any work for the purpose of insuring compliance with this ordinance.

(c) Building Moving Permits. The Tree Protection Advisor, along with any other city departments, shall review and approve or disapprove all applications for building moving permits to ensure that such movement will not endanger any tree specified in this ordinance.

Sec. 8-6. Application for Permit. (Amended No. 1841 on August 24, 1989.)

Any person wishing to obtain a permit to remove a protected tree shall make a written application to the Tree Protection Advisor through the Building Official with a filing fee of Twenty-five dollars (\$25.00). Where an application as required by this article has been submitted, no permit shall be issued until a tree site plan for the lot or parcel has been submitted by the applicant to the Tree Protection Advisor and reviewed and approved by the Tree Protection Advisor. Upon a proper showing by the applicant of extreme hardship, due to causes unrelated to the acts or omissions of the applicant, the Tree Protection Advisor, in his discretion, may waive all or part of the requirements for the tree site plan submission.

Sec. 8-7. Criteria for Issuance of Permit.

After application is filed with the Building Department, the Tree Protection Advisor shall consider the following criteria in the approval or denial of a tree permit for the removal, relocation, or substantial alteration of a protected tree:

(a) The condition of the tree or trees proposed to be removed with respect to disease, insect attack, danger of falling, proximity to existing or proposed structures and interference with utility services.

(b) The necessity of removing the tree or trees in order to construct the proposed improvements or structures to allow reasonable economic use of the property.

(c) The effect of removal on erosion, soil moisture retention, flow of surface waters and coordination with the drainage system plan of the City of Gulfport, Mississippi.

(d) The number and density of trees in the area and the effect of tree removal on property values of the neighborhood and other existing vegetation.

(e) Whether any tree proposed to be removed is worthy of preservation.

(f) Impact upon the urban and natural environment, including:

(1) Whether tree removal would substantially alter the water table or affect the stability of ground and surface water.

(2) Whether tree removal would affect water quality and aquifer recharge by reducing the natural assimilation of nutrients, chemical pollutants, heavy metals and other substances from ground and surface waters during the movement of water towards an aquifer or natural stream.

(3) Whether tree removal would have an adverse impact upon existing biological and ecological systems.

(4) Whether tree removal would affect noise pollution by increasing source noise levels to such a degree that a public nuisance or violation of noise control would occur.

(5) Whether tree removal will affect air movement by significantly reducing the ability of existing vegetation to reduce wind velocities.

(6) Whether tree removal will affect quality by significantly affecting the natural cleansing of the atmosphere by vegetation.

(7) Whether tree removal will affect wildlife habitat by significantly reducing the habitat available for wildlife existence and reproduction or causing the emigration of wildlife from adjacent or associated ecosystems.

(g) The ease with which the applicant can alter or revise the proposed development or improvement to accommodate existing trees.

(h) The economic hardship that would be imposed upon the applicant were the permit denied.

(i) The heightened desirability of preserving tree cover in densely developed or densely populated areas.

(j) The need for visual screening in transitional zones or relief from glare, blight, commercial or industrial ugliness or any other visual affront.

(k) Whether the continued presence of the tree or trees is likely to cause danger to a person or property.

(l) Whether the topography of the area in which the tree or trees is located is of such a nature to be damaging or injurious to trees.

(m) Whether the removal of the trees is for the purpose of thinning a heavily wooded area where some trees will remain.

Sec. 8-8. Tree Relocation or Replacement.

As a condition to the granting of a tree removal permit, the applicant may be required to:

(a) Relocate those protected trees which would otherwise be destroyed to another location upon the site, or;

(b) To replace those protected trees which will be destroyed with suitable replacement trees elsewhere within the site. In determining the required relocation or replacement of trees, the Tree Protection Advisor shall consider the needs of the intended use of the property, including all lands dedicated to public use, together with an evaluation of the following:

- (1) Existing tree coverage on the site and in the immediate surrounding area.
- (2) Number of trees to be removed on the entire site.
- (3) The type, site and condition of the tree(s) to be removed.
- (4) The area to be covered with structure, parking and driveways.
- (5) The feasibility of relocating the particular tree or trees.
- (6) Topography and drainage of the site.
- (7) The extent to which the tree(s) contribute to the aesthetic, economic and environmental integrity of the surrounding area.

Each replacement tree shall have characteristics comparable to those of the protected tree removed, and shall be a minimum of one and one-half (1-1/2) inch caliper nursery stock, seven (7) feet minimum height after planting. The type of replacement trees and location of relocated or replacement trees shall be identified by the Tree Protection Advisor prior to issuance of a tree permit. Each replacement tree shall enjoy the same protection as any protected tree with a total caliper trunk of eight (8) inches or a circumference of twenty-five (25) inches or more. Each replacement tree shall be replaced at a 1 to 1 ratio.

Where the residual density of natural trees (any species with a total caliper trunk of two (2) inches or six and one-quarter (6.25) inches in circumference or larger) in any lot or site is greater than the standards listed below, the requirement for replacement trees to be planted will be waived. If the residual density of natural trees is less than the standards listed below, the property owner or developer will be required to plant trees to the proper density.

<u>Site Area</u>	<u>Required Trees</u>
0 to 10,000 sq. ft.	1 tree/1,000 sq. ft.
10,000 to 110,000 sq. ft.	10 trees for first 10,000 sq. ft. plus 1 tree/2500 sq. ft. over 10,000 sq. ft.
over 110,000 sq. ft.	50 trees for first 110,000 sq. ft. plus 1 tree/5000 sq. ft. over 110,000 sq. ft.

Sec. 8-9. Trimming Pruning, Planting and Removal of Trees on Public Property, Permit Required.

(a) Except as provided herein, any person desiring to remove, destroy, cut, severely prune, including the root system, or treat any tree in and upon any public street or public property owned by the City of Gulfport, its agencies, boards, authorities and commissions, shall first obtain a written permit from the Tree Protection Advisor. Any work performed under such permit must be done in strict accordance with the conditions of the permit and the provisions of the chapter.

(b) Individual permits shall not be required of public and private utility companies which install overhead and underground utilities (including cable television and water and sewer installations by or at the direction of the Gulfport Public Works Department), provided that a determination is made that the

services provided by them are necessary for the general health, safety, and welfare of the citizens of Gulfport. Their actions that would ultimately result in the destruction of any tree designated by this ordinance shall be limited to the amount necessary in order to provide such utility service. The companies' written pruning and trenching specifications along with specific site locations shall be reviewed by the Tree Protection Advisor for their comments.

(c) Any person desiring to plant a tree upon any public street or public place must also obtain a permit from the Tree Protection Advisor. However, before issuance of a permit to plant, the request must also be reviewed by the Traffic and Safety Engineer for the City to determine if the proposed planting would create a sight distance hazard for traffic. The filing fee of twenty-five dollars (\$25) will be waived in obtaining this permit.

Sec. 8-10. Injuring Trees on Public Places.

(a) It shall be unlawful for any person, except with a written permit, to place or maintain upon the ground in any public street or public place, any stone, cement or other impervious matter or substance in such a manner as may obstruct the free access of air and water to the roots of any tree in any such street or place.

(b) It shall be the responsibility of the person in charge of the erection, repair, alteration or removal of any building or structure, to place a guard or protector around any tree on public ground so as to prevent injury to such tree arising out of such erection, repair, alteration, or removal. If the erection, repair, alteration, or removal of any structure shall require the trimming, pruning or removal of any tree upon public ground, a written permit shall be obtained as provided in Section 8-9.

-(c) It shall be unlawful for any person to attach to any tree in and upon any public street or public place or to the guard or stake intended for the protection of such tree, rope, wire, chain, sign, or other device whatsoever except for the purpose of protecting it.

Sec. 8-11. Trees Adjacent to Public Property to be Kept Trimmed.

Trees standing in or upon any lot or land adjacent to any public right-of-way or public place and having branches, limbs, trunks, or other parts projecting into the public right-of-way place which have been determined by the City Traffic and Safety Engineer or his designee to interfere with the free and safe passage and line of sight along the public way by pedestrians and vehicular traffic may be kept trimmed by the City of Gulfport.

Section 8-12. Construction Near Trees.

During construction, the builder shall be required to erect suitable protective barriers around all such protected trees to be preserved. Excluding sidewalks and driveways, no person shall pave with concrete, asphalt, or other impervious material within five (5) feet of the outside diameter of any tree. If necessary, the Tree Protection Advisor will require additional footage beyond the minimum requirement of five (5) feet from the outside diameter of any protected tree to prohibit any impervious materials. During construction, no attachments or wires other than protective guy wires shall be attached to any trees. Filling under the spread of limbs of any protected tree is hereby limited to one (1) inch of soil unless protective measures are taken as approved by the Tree Protection Advisor.

Sec. 8-13. Restricted Trees.

No tree shall be allowed to grow in such a manner as to interfere with the visibility of vehicular traffic thereby creating a situation that is dangerous to the public health, safety and welfare. Such determination shall be made by the City Traffic and Safety Engineer and/or his designee, and upon a finding of interference, such trees may be trimmed or removed as allowed in Section 8-11 above.

Sec. 8-14. Temporary Waiver Following Disaster.

In case of emergencies, such as wind storms, ice storms, fire, or other disasters, the requirements of this chapter may be waived by the Mayor and City Council during the emergency period so that the requirements of this chapter would in no way hamper private or public work to restore order in the City. This shall not be interpreted to be license to circumvent the intent of this chapter.

Sec. 8-15. Permit Exemptions.

(a) All tree nurseries that are legally recognized by the City of Gulfport shall be exempt from the terms and provisions of this ordinance only in relation to those trees which are so planted and growing for the sale or intended sale to the general public in the ordinary course of business, or for some public purpose.

(b) All groves of trees in active commercial operation shall be exempt from the term and provisions of this ordinance for bona fide agricultural purposes only.

(c) The removal of trees on public rights-of-way conducted by or on behalf of a federal, state, county, municipal or other governmental agency in pursuance of its lawful activities or functions in the construction or improvement of public rights-of-way.

Sec. 8-16. Enforcement of Article.

The Tree Protection Advisor and the Building Department shall be charged with the enforcement of this ordinance. For the purpose of enforcement, the Tree Protection Advisor and the Building Official are hereby empowered to ensure that the provisions of this ordinance are not violated, including the issuing of citations for the violations of any provisions of this ordinance. The Tree Protection Advisor or their authorized designee and the Building Official may periodically inspect sites subject to the provisions of this ordinance.

If, through inspection, it is determined that a person has failed to comply with the provisions of this ordinance, a notice to comply shall be served upon that person by certified mail from the Tree Protection Advisor or the Building Official. The notice shall set forth all the provisions which will be necessary to comply with the ordinance.

The Tree Protection Advisor and the Building Official shall have the power to conduct such investigations as deemed reasonably necessary to carry out duties as prescribed in this article, and for such purpose may enter at reasonable times upon any property, public or private, for the purpose of inspecting the sites subject to the provisions of this ordinance. No person shall refuse entry or access to the Tree Protection Advisor or their authorized representatives and the Building Official who may request entry for the purpose of inspections, and who presents appropriate credentials, nor shall any person obstruct, hamper or interfere with such representative while in the process of carrying out their official duties.

Sec. 8-17. Variances and Appeals from the Decision of the Tree Protection Advisor.

(a) A variance from the provisions of this ordinance may be considered by the Gulfport Planning Commission in cases of unusual circumstances and special conditions where the literal enforcement of the provisions of this ordinance would result in depriving the property owner of the reasonable use of land.

(b) In the event any person is dissatisfied with a decision of the Tree Protection Advisor adversely affecting such person involving the application of this ordinance, such person may appeal to the Gulfport City Planning Commission by filing written notice thereof with the Planning Commission and with a copy to the Tree Protection Advisor within fifteen (15) days after the decision of the Tree Protection Advisor. The Planning Commission shall hear any complaints of such person, and after a full and complete hearing, the Commission shall render its opinion affirming,

overruling, or modifying the decision of the Tree Protection Advisor based upon the criteria set forth in Section 8-7. Each appeal shall be accompanied by a fee of fifty dollars (\$50) to cover the cost of publishing and mailing notices of such hearing.

The Planning Commission shall prepare a record of its proceedings for each case, showing the grounds for its decision. The record shall be filed in the office of the Planning Commission and shall be available to the public for review.

(c) Any person or any officer, department, or agency of the City aggrieved by any decision of the Planning Commission may within fifteen (15) days thereafter appeal to City Council by filing with the Minutes Clerk of the City Council by a written notice of appeal specifying the decision from which the appeal is taken. In case of such appeal, the Planning Commission shall cause a certified transcript of the proceedings in the case to be filed with the City Council, and the matter will be heard on said transcript, the cost of said transcript to be borne by said appellant.

(d) Any person feeling aggrieved at the findings and decisions of the Mayor and City Council of the City of Gulfport shall have the right to appeal to a court of competent jurisdiction and shall be governed by applicable statutes of the State of Mississippi.

Sec. 8-18. Penalties.

It shall be unlawful for any person, firm, organization or society to violate the provisions of this ordinance. The removal or destruction of each protected tree shall constitute a separate offense under this ordinance, and said violation shall be punishable in accordance with Section 1-9 of the Code of Ordinances of the City of Gulfport.

Sec. 8-19. Conflict with Other Laws.

Whenever the requirements of this ordinance are at variance with the requirements of any other lawfully adopted rules, regulations, or ordinances, the most restrictive or that imposing the higher standards shall govern.

Sec. 8-20. Separability and Effective Date.

(a) Separability. Should any section or provision of this ordinance be declared by the courts to be unconstitutional or invalid, such decision shall not effect the validity of the ordinance as a whole, or of any part thereof other than the part so declared to be unconstitutional or invalid, and the remainder of this ordinance shall remain in full force and effect.

(b) Effective Date. This ordinance shall take effect and be in force thirty (30) days from and after its passage and shall be published as provided by law.

The above and foregoing Ordinance, after having been first reduced to writing and read by the Clerk, was introduced by Thatcher, seconded by McDaniel, and was adopted by the following roll call vote, to-wit:

YEAS:

Jenkins Peden
Thatcher Sinopoli
McDaniel

NAYS:

None

The President thereby declared the motion carried and the Ordinance adopted, this the 20th day of June, 1989.

(SEAL)

ATTEST:

Anne Peterson
CLERK OF THE COUNCIL

ADOPTED:

Himbert Sinopoli
PRESIDENT

The above and foregoing Ordinance having been submitted and approved by the Mayor, this the 28th day of June, 1989.

APPROVED:

Leroy Urie
MAYOR



U.S. Department
of Transportation

Research and
Special Programs
Administration

U.S. Department of Transportation
Washington, D.C. 20590

SEP 14 1995

Mr. Donald E. Bergen
Chairman, Lake Havasu City
Planning & Zoning Commission
3575 Wayward Wind
Lake Havasu City, AZ 86406

Dear Mr. Bergen:

This is in response to your letter of July 28, 1995, requesting clarification of whether government vehicles traveling on public highways are required to be placarded under the Hazardous Materials Regulations (HMR; 49 CFR parts 171-180).

Shipments of hazardous materials transported by a government entity in vehicles operated by government personnel for noncommercial purposes are not subject to the HMR (including placarding). However, if the purpose is commercial or if the government entity offers hazardous material for transportation to commercial carriers, then the HMR apply.

I hope this information is helpful.

Sincerely,

Delmer F. Billings
Chief, Regulations Development
Office of Hazardous Materials Standards

7824
Ap 1 of 1

4WD-FFB

April 13, 1998

MEMORANDUM

SUBJECT: Assuring Land Use Controls at Federal Facilities

FROM: Jon D. Johnston, Chief
Federal Facilities Branch

TO: Federal Facilities Branch

I. PURPOSE AND APPLICABILITY

This memorandum establishes EPA Region 4 Federal Facilities Branch policy on measures to be taken to assure the long-term effectiveness of land use controls (LUCs) being relied upon to protect human health and the environment at contaminated federal facilities undergoing remediation pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and/or the Resource Conservation and Recovery Act (RCRA). The purpose of this policy is to establish uniform requirements for efficient oversight of LUC remedy components at federal facilities and to clarify our expectations and criteria for concurring on remedies including LUCs. This policy should not be interpreted as altering the Region's preference for active and permanent remedies consistent with CERCLA and RCRA remedy selection criteria. We continue to regard LUCs primarily as components of, or enhancements to, remedies which employ treatment that reduces toxicity, mobility, or volume as a principal element.

Effective with issuance of this memorandum, it is Federal Facilities Branch policy to require -- as a precondition to concurrence on any remedial and/or corrective action involving any reliance on one or more LUCs for the protectiveness of that action -- that the lead federal agency seeking EPA's concurrence commit itself to implementing a detailed written LUC Assurance Plan (LUCAP) designed to assure the effectiveness and reliability of the required LUC(s) for as long as any LUC continues to be required in order for the remedial/corrective action to remain protective.¹ Such a requirement is consistent with this Agency's obligation, for example under

¹ During the initial ninety (90) days after this policy is issued, the requirement for a federal agency to commit to a LUCAP may be waived as a precondition to EPA's concurrence on any action which, in the opinion of the Federal Facilities Branch Chief, might be unduly delayed if this precondition were applied.

CERCLA remedy-selection criteria established in the National Contingency Plan at 40 C.F.R. §300.430(e)(9)(iii), to assess the long-term reliability of ongoing remedial measures as part of evaluating a remedy's effectiveness in protecting public health and the environment. This policy applies with respect to federal facilities which are expected to remain in the control of the federal agency for the foreseeable future. Because of significant differences in the kinds of measures which may be required to assure the effectiveness of LUCs after property passes out of direct federal agency control, this policy is not specifically applicable to situations involving imminent transfer of the facility to a private party; however, the objectives of this policy -- to assure long-term effectiveness of LUCs -- and the approach this policy utilizes for such assurances may be utilized for some situations involving a property transfer. This policy is applicable to Region 4 federal facility: 1) CERCLA actions at NPL sites; and 2) HSWA corrective actions within non-HSWA authorized states. For their consideration as guidance, the policy will be provided to HSWA-authorized states and to those federal facilities taking CERCLA actions on non-NPL sites.

II. APPLICABLE DEFINITIONS

As used in this policy, the term "*Land Use Control*" or "*LUC*" in regard to real property on federal facilities should be broadly interpreted to mean any restriction or control, arising from the need to protect human health and the environment, that limits use of and/or exposure to any portion of that property, including water resources. This term encompasses "institutional controls," such as those involving real estate interests, governmental permitting, zoning, public advisories, deed notices, and other "legal" restrictions. The term may also include restrictions on access, whether achieved by means of engineered barriers such as a fence or concrete pad, or by "human" means, such as the presence of security guards. Additionally, the term may involve both affirmative measures to achieve the desired restriction (e.g., night lighting of an area) and prohibitive directives (no drilling of drinking water wells). Considered altogether, the "LUCs" for a facility, in conjunction with the base master plan, will provide a blueprint for how its property should be used in order to maintain the level of protectiveness which one or more remedial/corrective actions were designed to achieve.

The term "*Land Use Control Assurance Plan*" or "*LUCAP*" is a written installation-wide plan that sets out the procedure to assure LUCs remain effective over the long-term for all areas at the particular installation where they are required. Because of its procedural nature, there will normally be only one LUCAP per installation (although a number of "substantive" LUC Implementation Plans may be appended to it). Minimum contents of a LUCAP are listed below in Part A of Section IV.

The term "*LUC Implementation Plan*", as used in this policy, refers to a written plan, normally developed after a decision document has required one or more LUCs for some particular area (operable unit, contaminated unit, and/or solid waste management unit) which 1) identifies each LUC objective for that area (e.g., to restrict public access to the area for recreational use) and 2) specifies those actions required to achieve each identified objective (e.g., install/maintain a

fence, post warning signs, record notice in deed records). LUC Implementation Plans specify what must be done to impose and maintain the required LUCs, and are therefore analogous to design and/or operation and maintenance plans developed for active remedies.

The term "*decision document*," as used in this policy, refers to CERCLA Records of Decision (RODs), RCRA Statements of Basis/ Notices of Decision, and RCRA Permit Modifications.

As used in this policy, the term "*facility*" refers to a military base or other entire federal installation, whereas the term "*site*" refers to a particular area (such as an "operable unit") making up only a portion of the facility.

The term "*monitoring*" is used in this policy to indicate a variety of investigative activities, ranging from mere "drive-by" visual observations to detailed scientific sampling and testing. The nature of the particular Land Use Controls being implemented will determine the type(s) and extent of any "monitoring" activities provided for under this policy.

III. BACKGROUND

CERCLA and RCRA require cleanup of hazardous substances which have been released into the environment to a degree which is determined to be "protective of human health and the environment." How a piece of land is anticipated to be used in the future is frequently an important consideration in determining the extent of remediation necessary to achieve the required protectiveness. For example, assumptions about whether a piece of land is likely to be used in the future for residential or industrial activities may influence the evaluation of exposure pathways made during the baseline risk assessment, thereby affecting the likely exposure scenario, the resultant risk determined to be present, and consequently how much (if any) cleanup is needed to lower that risk to "protective" levels. Similarly, one or more aspects of a remedy chosen as the means of lowering the risk to "protective" levels may involve deliberate efforts to maintain or impose some limitation on future use of the property, such as limiting physical contacts with contaminated soil through engineered barriers or limiting legal rights to use ground water resources by recorded deed restrictions, covenants or "institutional controls."

In such circumstances, uncertainties about the future use assumptions and/or the ongoing effectiveness of the use limitations imposed are directly related to achievement of the central objective of the entire remediation process -- protection of human health and the environment. In light of EPA experience in this Region and elsewhere, that land use control and environmental protection programs have not been adequately coordinated to ensure adherence to LUCs, we believe that it is essential to adopt new, more reliable means for assuring that necessary LUCs are maintained. Because we regard inadvertent violations as the most probable reason why LUCs might not be maintained on federally-controlled property, we think that it is important for each federal facility relying on LUCs to commit to implementing an active LUC-monitoring process, and to raise the visibility of its LUCs through periodic reporting/certification by each such

facility's base commander or top civilian manager reaffirming the ongoing integrity of LUCs to EPA and state environmental regulators. As described below, this process should be embodied in a facility-specific Land Use Control Assurance Plan (LUCAP).

IV. IMPLEMENTATION

A. **Land Use Control Assurance Plan:** A LUCAP may be documented in a number of different ways, for example, in a Memorandum of Agreement (MOA) or a Federal Facility Agreement (FFA) between EPA, the State and the federal installation or service. The LUCAP should also be referenced in the base master plan. The LUCAP may be developed and signed prior to the next planned decision document in anticipation of its need, or its development within a specified time may be required by the next decision document, as a condition of EPA's concurrence. In the absence of an approved LUCAP or some specific, time-bound requirement for the development of one, the provisions of a LUCAP, as described below, shall be incorporated into any decision document that requires LUCs. Once the installation-wide LUCAP is in place, additional site-specific LUC Implementation Plans will be appended to it as final cleanup decisions are made.

All LUCAPs will include, at a minimum, the following:

- 1) A requirement that, after each decision document selecting any LUC, a LUC Implementation Plan must be developed and approved for the subject site (operable unit, corrective action unit and/or solid waste management unit). The LUC Implementation Plan must identify the land area under restriction (e.g., by a certified survey plat) and the LUC objectives for that area, and must specify the particular controls and mechanisms which will be used to achieve each identified LUC objective. Each site-specific LUC Implementation Plan will be attached to the LUCAP as it is approved so that the LUCAP will serve as a single facility-wide source documenting all LUCs.
- 2) Identification of the federal facility program and point-of-contact designated responsible for monitoring, maintaining and enforcing site-specific LUC Implementation Plans and site-wide LUCAP.
- 3) A commitment by the facility to request funds for maintaining LUCs in budget allocation requests.
- 4) A requirement for quarterly on-site monitoring by the facility for compliance with the LUC Implementation Plans throughout the remediation period, unless another monitoring frequency is approved in the LUC Implementation Plan.
- 5) A requirement for the facility to provide notification to EPA and state regulators and obtain their written concurrence whenever the facility anticipates any "major changes in

land use” (defined below) for the sites subject to LUCs. The facility should notify the regulatory agencies as soon as a major land use change is anticipated in order to allow sufficient time for regulatory review and amendments to remedy selection decision documents. Such notifications should be made to the regulatory agencies at least 60 days prior to a major change in land use and should include:

- a) an evaluation of whether the anticipated land use change will pose unacceptable risks to human health and the environment or negatively impact the effectiveness of the remedy;
- b) an evaluation of the need for any additional remedial action resulting from the anticipated land use changes; and
- c) a proposal for any necessary changes to the selected remedial action, and identification of procedural requirements (e.g., ROD amendment/RCRA permit modification) for the proposed changes.

The regulatory agencies should provide a written response in a timely manner after the facility’s notification and request for review, taking into account the need to minimize any adverse impact upon facility operations.

The following are considered “major changes in land use”:

- a) A change in land use that is inconsistent with the exposure assumptions in the risk assessment that was the basis for the LUCs (either human health or ecological risk assessment). For example, the human health risk assessment assumed that a site is in “caretaker” status with a worker visiting the site once a week for 2 hours, and the proposed change in land use would have the worker at the site for 8 hours a day, 5 days a week. Any change from industrial, commercial or recreational land use to a more sensitive land use, such as housing, schools, hospitals, and/or day-care centers is a major land use change. Similarly, any change from industrial or commercial land use to recreational land use is also considered “major changes in land use.” Further, any change in a land use that has been prohibited in order to protect the environment is also a major land use change. For example, an area with residual contamination may be prohibited from being used for creation of wetland habitat and the land use change would result in the creation of a wetland.
 - b) Any action that may disrupt the effectiveness of the remedial action. For example, excavation at a landfill, groundwater pumping that may impact a groundwater pump and treat system, or a construction project that may result in unacceptable exposure to an ecological habitat protected by the remedy.
 - c) Any other action that might alter or negate the need for the LUC. For example, any plan to actively remediate a site subject to LUCs in order to allow for unrestricted use.
- 6) A requirement for the facility to conduct field inspections at least annually to assess the

conditions of all sites subject to LUCs. These inspections shall determine whether the current land use remains protective and consistent with all remedial action/corrective measures objectives outlined in the decision document.

- 7) A requirement for the designated official responsible for the facility operations (e.g., DOD Base Commander, DOE Site Manager) to certify the continued compliance with all site-specific LUC Implementation Plans described in an annual report to specified EPA and State officials. The annual report shall also serve to notify agencies of a change in designated officials or of land use changes that are not considered major under subparagraph 5 above.
- 8) A requirement for the facility to notify EPA and the State immediately upon discovery of any unauthorized "major change in land use" or any activity inconsistent with any LUC Implementation Plan and to describe what actions will be taken to ensure protectiveness.
- 9) A requirement for advance notification to EPA and the State in the event of that the facility contemplates any transfer, by sale or lease, of sites subject to LUCs in order to ensure adoption of such additional measures as may be needed to assure continued compliance with LUCs on the transferred property.

B. Decision Documents: All decision documents for sites at which the remedy involves LUCs will require reasonable assurances that LUCs will be effectively maintained and monitored. Compliance with a LUCAP which includes the minimum provisions listed above in Part A of this Section is one method for satisfying this requirement. Decision documents establishing LUCs shall specify the general land use designation, the associated land use exposure assumptions and the general LUC objectives. The following information should be specified in any decision document requiring LUCs:

- 1) Assumptions made concerning current and expected future land use designation/exposure scenarios. The land use scenario(s) used in risk assessment upon which the risk management and remedy decisions are premised should be stated. Identify the Lead Agency's Current and Future Land Use Designation, how such designations were developed, and the human health/ecological exposure scenarios which may not be protective under less restrictive land uses. Specify the time period necessary for remediation/corrective measures and LUCs.
- 2) Identification of the LUC objectives that are necessary to ensure the protectiveness of the remedy decision. Specific means to achieve the LUC objectives may be included in the decision document on a case-specific basis. In general, the specific means of achieving the LUC objectives will be included in the site-specific LUC implementation plan.
- 3) A requirement to develop a site-specific LUC Implementation Plan, which will include site-specific controls and controls necessary to assure the protectiveness of the selected

remedy. The LUC Implementation Plan may include, for example, site access controls, site security, operation and maintenance activities necessary to maintain any physical access control features, drilling controls, groundwater use controls, signs, etc.

C. Existing Decision Documents with LUCs: At some federal facilities one or more previously completed decision documents containing LUCs are currently in place. EPA intends to address these issues as a part of the 5 Year Review and/or as a part of the the HSWA permit review. The review process should include an analysis of the effectiveness of LUCs, with emphasis on those LUCs not subject to a LUCAP. This policy is not intended to imply automatic reopening of previously completed decision documents. As needs are identified, EPA, in coordination with the state, will negotiate a schedule for developing LUC Implementation Plans with the affected facility. These LUC Implementation Plans will then be appended to the facility-wide LUCAP. If a facility-wide LUCAP has not been developed, EPA will require submission of a LUCAP at the time the site-specific LUC implementation plans are due, in accordance with the negotiated schedule.

V. DISCLAIMER

This memorandum is intended solely to guide employees of the Federal Facilities Branch, EPA Region 4, in carrying out their responsibilities with respect to federal facility actions to which the guidance is expressly made applicable. It is also being distributed to HSWA-authorized Region 4 states and to certain federal facilities taking CERCLA actions at non-NPL sites within Region 4 for their consideration as guidance. This policy does not constitute rulemaking by EPA and does not create legal rights or obligations in any person or entity.

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